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The Electrified Home.

THE paper read by Mr. H. H. Berry at the I.M.E.A. Convention and the discussion that followed, which are reported elsewhere in this issue, fully maintained the interest that had been manifest at the two previous meetings. The author advocated what one speaker described as "a sort of half-way house," but three parties were represented in the discussion—those who agreed with him, those who, with Dr. Ferranti, favoured the (literally) "all-electric" house, and those who realised the difficulties that stood in the way of attaining that ideal, principally in point of cost.

It must be recognised, as the women especially urged, that the vast majority of actual consumers and the far greater number of potential consumers live in houses that are already built, most of which are rented, and that the cost of installing, extending, or modernising a hot-water system is beyond their means. Undoubtedly the ideal system is such a one as hundreds of the visitors were privileged to inspect at Baslow Hall, thanks to the courtesy of Dr. and Mrs. Ferranti, to whom both the E.A.W. and the I.M.E.A. are greatly indebted. But that unique installation was carried out at a heavy capital outlay and under expert supervision. What is to be done in the normal case?

Frankly—and as we have said on previous occasions—we feel bound to vote for the "half-way house." Where a supply of electricity can be obtained, as at Glasgow, during restricted hours for little more than ¾d. per kWh, electricity may be used for general heating; and where one owns the house and can afford the outlay, or where the house is as yet unbuilt, it may be equipped for that purpose to great advantage—but those are exceptional conditions, and in the ordinary case, numbered by the million, the all-electric ideal must be forgone in favour of a compromise. Mr. Berry, with inimitable eloquence, argues in favour of a central-heating and convector system, admirable in its way, but as the lady speakers remarked, of no use to the masses who live in existing houses. Leaving apart, however, the question of distributing hot water about

the house, there appears to be little room for doubt that, given a supply of electricity for heating at a reasonable price (certainly not more than 1d. per kWh), the most economical course to follow, as regards both initial outlay and running cost, is that which was recommended by the Advisory Committee on Domestic Supplies of Electricity, in the report which was quoted in Mr. Berry's paper—namely, to use coal or coke "in well-designed grates or furnaces for heating and mass production of hot water at one or two points in the house, the cooking being carried out on the electric range, occasional room warming with electric fires, and much of the housework by means of electrically driven appliances."

"Houses equipped in this manner," says the Committee, "give the occupants great satisfaction, and generally consume about ten times as much electricity in the year as they would for lighting alone." Be it noted that this system does not include the use of water for heating the house. It has been very widely adopted, and it has been shown by the Electrical Development Association that the saving in chimneys, &c., to which Mr. Berry also refers, pays for the cost of the complete electrical installation in a new house. Moreover, the system is suitable for even the smallest houses, and has indeed been employed in thousands of dwellings built under housing schemes. It is the nearest feasible approach to the ideal all-electric house for those of small and moderate means, and—a matter of the greatest importance—it can be applied to existing houses.

Although Mr. Berry appears to identify the Advisory Committee's system with his own proposition, the "Colectric system," it appears to us that the latter essentially employs central heating with convectors, which do not necessarily form part of the former. We accept his system as an admirable one for those who can afford it, a particular case of the problem; but in general that condition is not fulfilled, and the practicable must take precedence of the preferable.

In dealing with this question we think attention should be drawn to two points made by a woman Councillor—Mrs. Gregory, of West Ham—in the discussion—namely, that more women should be appointed on municipal electricity committees, to give the woman's point of view; and that domestic electrical appliances should be cheaper. Women can be co-opted, if they are not available as Councillors, and we think the inclusion of one or more women on a Committee would undoubtedly prove beneficial to domestic consumers. With regard to the latter suggestion, whilst the extending use of electrical apparatus certainly tends to lower the cost of production, the process is slow; there is no question but that the high prices of many electrical appliances present an insurmountable obstacle to their introduction into small houses, and manufacturers would serve the public interests if, without reducing the safety factor, they placed on the market in addition to the devices with which we are familiar, simple appliances constructed on the most economical lines.

The Patent Office Report.

THE forty-fourth annual report of the Comptroller-General of Patents, Designs and Trade Marks, issued under date May 9th, 1927, contains the usual full information about the activities of that department of Government, and sets it forth in a clear and concise manner which might well be an example to less useful branches of the Civil Service.

The number of patent specifications applied for constantly rises, having increased from 21,839 applications in 1918 to 33,080 in 1926. Of these applications about half were eventually sealed. On page 16 a table of mortality is given which probably corresponds fairly closely with the mortality statistics amongst the actual inventors. From this interesting table it appears that half the patents applied for up to 1922 reached the age of 5 years, 17 per cent. lived to be 10 years of age, and only 4.8 per cent. reached maturity in their sixteenth year. This table conjures up a painful vision of inventors expiring in garrets and cellars at a comparatively early age from failure, disappointment, and inability to pay the sums demanded for renewal fees. The report shows that from this notoriously struggling and impecunious fraternity the Treasury managed to extort no less a sum than £98,813, being the balance of receipts over expenditure which passes as in former years into its hands. We have referred before to this large surplus handed over year by year by the Patent Office as a "brain tax," and we are still of the opinion that the description is justified. Probably every pound so obtained by the Treasury represents a loss of hundreds in ordinary income tax which would have been secured had the patents and the patentees not been taxed out of existence at an early stage in their development.

As we have many times pointed out, the Americans know better; their fee of £7 down secures for the inventor a patent, carefully edited, after a most elaborate and complete search, which is then his undisputed property for a period of 17 years without any other fees or taxes whatever. Eventually, if he succeeds, he becomes an important taxpayer, but if he fails his "intellectual property" is not taken away from him because he is unable to find large and increasing contributions year by year from the start.

We turn with relief to a pleasanter side of this report. While the total cost of the staff is £254,000, it will be observed from the complete list which is furnished that nobody is overpaid. An immense amount of work is carried through at the Patent Office, and on the whole with wonderful efficiency. The publications issued by the Office, of which this report is a fair sample, are exceedingly useful and well arranged, and every facility is given to the poor inventor to make searches on his own account if he cannot afford to take the safer course of employing a patent agent.

Time after time we have called the attention of the Government of the day to the opportunities of development of business and consequent large revenue which they are missing by their short-sighted policy of the brain tax, and we venture once again to urge upon the present Government that it would be a business move to pass a short Act establishing the patent fees on a similar basis to that prevailing in America, when we venture to predict that similar results in the matter of revenue and valuable inventions would follow.

The Necessity for Adequate Wiring.

THE supplier of electrical goods has a very direct interest in the number of outlets that are installed in the house that is wired for electricity. To be possessed of a number of outlets means for the user the ability to apply electricity in all the rooms for many purposes, and paves the way for the sale by the dealer of a host of domestic electrical appliances. There are thousands of houses using electricity to-day that are inadequately wired, simply because they were wired years ago, when the use of electricity was practically restricted to lighting. The majority of these homes would make a far greater use of electricity for heat and power if only they had the necessary extra outlets. House agents will glibly advertise houses as "wired for electricity," when every electrical man knows that these houses generally contain about a quarter of the wiring equipment which is necessary if the occupants are to obtain the fullest advantage from the use of electrical labour-saving devices. The housing demand is by no means satisfied yet; in the course of the next few years thousands of new residences will be going up, and the adequate wiring of these means thousands of potential electrical sales. In this connection the builder assumes importance. He should be asked to appreciate the fact that where, for example, the title of the property remains in his own hands, it is made more valuable in the event of sale by the provision of a complete electrical service. Much could be done in this way that at present is left undone.

Frederick Walter Purse,

President of the Incorporated Municipal Electrical Association, 1927-28.

AT the annual convention of the Incorporated Municipal Electrical Association at Buxton, Mr. F. W. Purse was elected president for the year 1927-28, and we have pleasure in reproducing his portrait herewith.

Like his immediate predecessor in the presidential chair—Mr. R. W. L. Phillips—Mr. Purse is a native of Bristol; he was educated at the Merchant Venturers' Technical College (which has since become the University of Bristol), where he won both junior and senior scholarships, and whilst at College he obtained many certificates in various engineering subjects, including the Honours Diploma of the City and Guilds of London Institute for electric light and power distribution. He entered the service of the Bristol Corporation Electricity Department in 1897, and was there associated with Mr. Phillips; two years later he became assistant engineer at Bath, and subsequently held the post of deputy-chief at Warrington for seven years. In 1908 he was appointed chief electrical engineer at Watford, and in 1913 he accepted a similar position at Carlisle; after spending six years in that position he returned to the south as chief engineer and manager of the Electricity Department of the County Borough of West Ham—the largest municipal electrical undertaking within 100 miles of London—and still occupies that post, having now spent 30 years continuously in municipal service, during 19 of which he has been in the seat of authority.

Photo by] [Russell.

Mr. F. W. Purse, M.I.E.E., M.I.Mech.E., President, I.M.E.A.

In addition to his normal duties Mr. Purse has for many years shouldered a burden of public service, serving on various committees in connection with the British Engineering Standards Association and the Institution of Electrical Engineers; as vice-chairman of the I.E.E. Wiring Rules Committee he has played a prominent part in the formulation and revision of the Rules, which, in his opinion, ought to be made compulsory and binding upon electrical contractors and supply authorities in general. He is also a member of the National Registration Board of Electrical Installation Contractors, hon. treasurer of the Associated Municipal Electrical Engineers, and past-president of the Greater London Centre of the A.M.E.E. He is a member of the Institutions of Electrical and Mechanical Engineers, and President of the Rotary Club of West Ham.

During the war Mr. Purse served as Captain with the 1st Vol. Battalion, Border Regiment, and chairman of the Carlisle Area Road Transport Committee; he was also a member of the East Cumberland Munitions Committee, and of the Management Committee of Carlisle National Shell Factory, and was a district engineer under the Coal Department of the Board of Trade. His literary activities have taken the shape of numerous papers and articles on problems connected with public electricity supply, his latest essay in that direction having been the article on "The Ascertainment of Kilowatt Maximum Demand" which was published in our issue for May 13th—a question of great importance to supply authorities which under the terms of the Act of 1926 will be called upon to give or take a bulk supply of electricity.

Under a somewhat blunt and uncompromising manner Mr. Purse conceals a warm heart and a sincere desire to serve his fellow-men, taking keen interest in the welfare of his subordinates and fighting the battles of the "under-dog"; in past years he has strenuously contended for the interests of the younger members of the Institution of Electrical Engineers, and has resisted the increase of their burdens at the annual meetings, which he never fails to attend—though latterly he has not had occasion to offer adverse criticism. At an earlier stage in his career, in collaboration with Mr. A. Nichols Moore (now vice-president of the I.M.E.A.), Mr. Purse championed the cause of the smaller municipal undertakings and ultimately secured for them direct representation on the Council of the Association. Since his promotion from the small to the large class of station, Mr. Purse has carried on at West Ham a progressive and energetic policy, directed towards the increase in efficiency of his undertaking and the reduction of cost to the consumer; he now controls generating plant aggregating 43,500 kW, with a maximum load of 24,500 kW, and an annual output of over 77 million kWh, serving a population of 318,000, with a large industrial load (the load factor is 35.8 per cent.). The prices charged for lighting, power and domestic purposes in West Ham are just about half those demanded over a large proportion of the Metropolitan area, and it will not be the fault of Mr. Purse if electricity is not universally adopted in the County Borough. Plain-spoken and business-like, he will conduct the affairs of the Association with efficiency and dispatch, and his period of office will be one of prosperity and achievement for the Association.

During the past year the President, Mr. Phillips, was kept so busy with the Electricity (Supply) Bill that he finally came to loathe it, and at the annual dinner of the Association he referred to the difficulties that would be experienced in the working of the Act; it falls to the lot of Mr. Purse to be in office while the Act is being brought into operation, and it is safe to say that he will have plenty of work to handle. With the support of a public-spirited and hard-working Council, he may be relied upon to do his utmost to ensure the success of the national scheme.

Stourport Electric Power Station.

A new 25-cycle capital generating station capable of extension to an ultimate capacity of 250,000 kW, designed to serve, in conjunction with other plant, the Central England district, a scheme for which is being prepared by the Electricity Commission.

(*Concluded from page* 917.)

THE circulating water for the condensing plant is conveyed to the pumps by twin ferro-concrete culverts, each measuring 62 sq. ft. in area, having a connection from the river at the one end, through fish screens and penstocks, to screen chambers, in which are two Waller 27-ft. diameter rotary screens. The discharged water is carried by a single ferro-concrete culvert, 59½ sq. ft. in area, to the river at the down-stream end of the site.

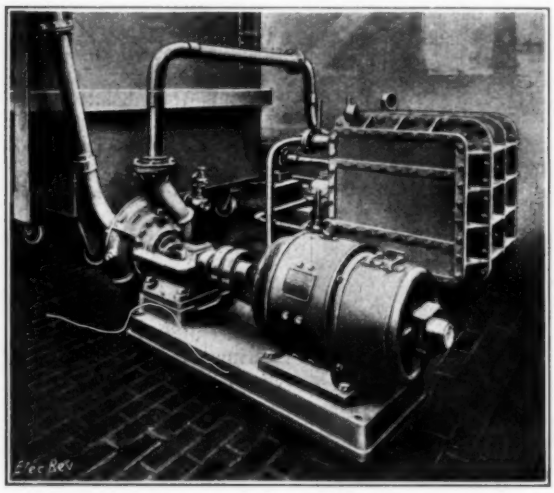


Fig. 8.—Main Transformer Oil Cooler.

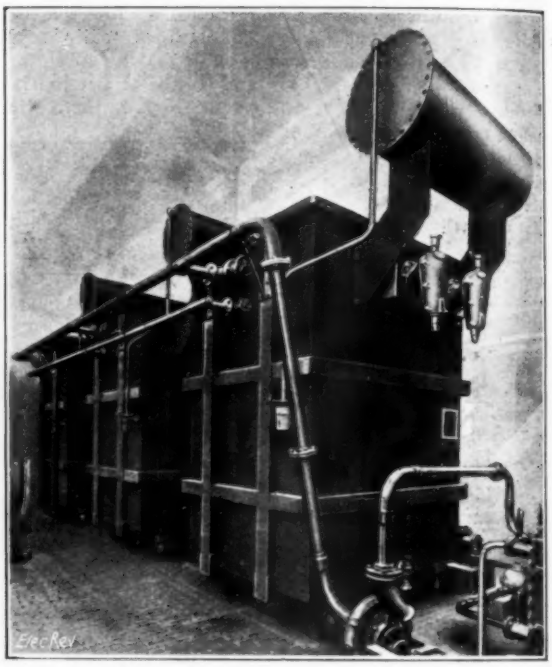


Fig. 9.—Main 5/33-kV Metrovick Transformers on Test.

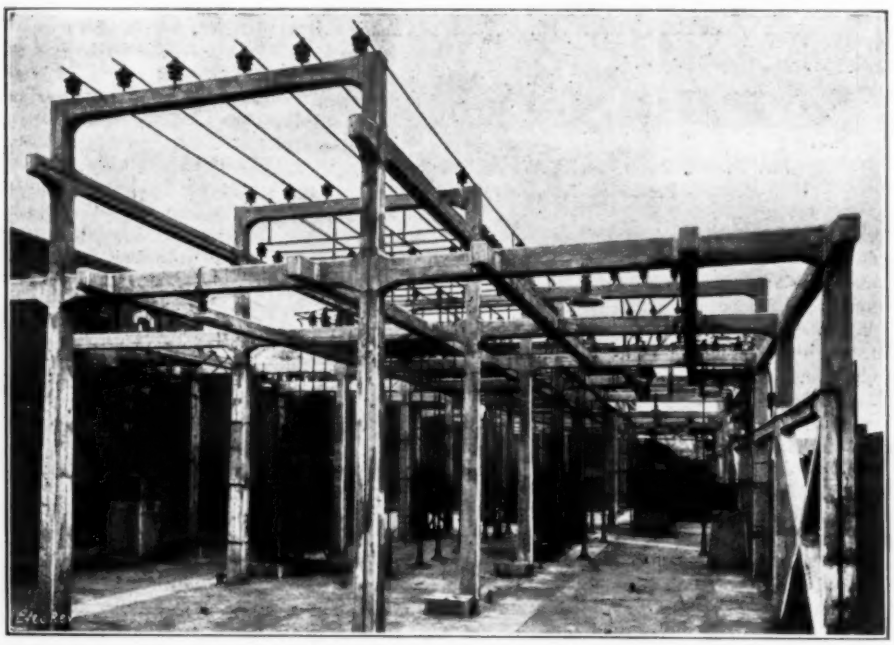


Fig. 10.—Halesowen Sub-station, 33,000 Volts, B.T.-H. Switchgear.

The 6,000-r.p.m. house turbo-generator drives through gears a multi-pole d.c. generator normally rated at 750 kW, 600 r.p.m., 1,630 amperes, 460 volts, designed for a steam pressure of 325 lb. per sq. in., with 246 deg. F. superheat, capable of carrying 25 per cent. overload for two hours. Its condenser was supplied by Cole, Marchent & Morley, Ltd., to maintain a 28-in. vacuum when dealing with 9,800 lb. of steam per hour, with circulating water supply at the rate of 58,700 gallons per hour at 70 deg. F.; it has a cooling surface of 1,300 sq. ft., and in order to be able to raise the vacuum quickly the plant is fitted with Edwards 3-throw air pumps having cylinders of 12 in. diameter by 12-in. stroke, running at 120 r.p.m., being driven by a B.T.-H. motor rated at 80 h.p., 600 r.p.m., 460 volts d.c. The circulating pump is driven direct by a B.T.-H. 15-h.p. motor running at 1,000-1,100 r.p.m., on a 460-volt circuit. A 750-kW rotary converter has also been installed.

For stepping up the output of the generating sets from 5,550 V to the distribution pressure of 33,000 volts, two 3-phase banks of transformers have been supplied by the Metropolitan-Vickers Electrical Co., Ltd.,

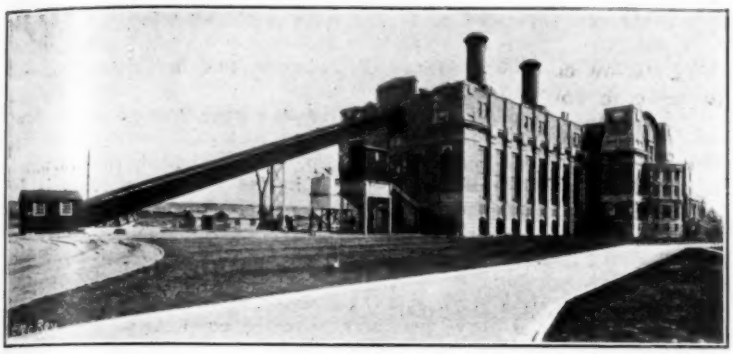


Fig. 11.—Coal Elevator, with Ash and Soot Bunkers Below.

each of a capacity of 22,500 kVA, consisting of three single-phase shell-type units of unusually large size on account of the low-frequency; each unit, with its tank and oil, weighs 33 tons. The tanks are of boiler iron with cast-iron covers and sealing bells for the entry of lead-covered cables on both the h.p. and l.p. sides: each has its own oil conservator and a calcium-chloride breather, and two sets of oil-cooling equipment accompany each bank, figs. 8 and 9, one cooler of each pair being normally in operation at a time, the other acting as a stand-by for use during overhauling and cleaning. The temperature of the oil is shown on dial-type indicating thermometers.

Apart from the metering instrument transformers and neutral earthing gear, no control switchgear is provided between the generators and main transformers, which are protected on the circulating-current system in addition to time-limit overload devices. Part of the station's output is reduced from 33 kV to 11,000 V, two transformers supplying the neighbourhood of the station and a third the station auxiliary plant; this local supply is further reduced by two 500-kVA transformers to 400 volts. The 25-cycle transformers supplied by the Brush Electrical Engineering Co., Ltd., include one of 2,500-kVA, 3-phase, and six single-phase forming two 4,500-kVA 3-phase banks, ratio 33,000/11,000 volts; also two of 1,500 kVA 3-phase ratio 33,000/11,000 V; one of 825 kVA 3/6-phase for use with the B.T.-H. rotary convertor, ratio 11,000/343 V with 20 per cent. internal reactance; and two of 500 kVA 3-phase, ratio 11,000/400 V for station service. All of them are of the oil immersed self-cooled core type, the boiler plate tanks being of the outdoor pattern with domed lids, expansion chambers, and calcium chloride breathers, and on the 33,000-volt cable boxes an expansion chamber and calcium chloride breather are fitted. All the transformers are of the outdoor type with distant thermometers in the control room; each stands in a brick cubicle without roof to localise trouble in the event of a tank bursting, with a pit below to trap the oil. The transformers stand on rails and a special truck facilitates removal (see fig. 6, last week).

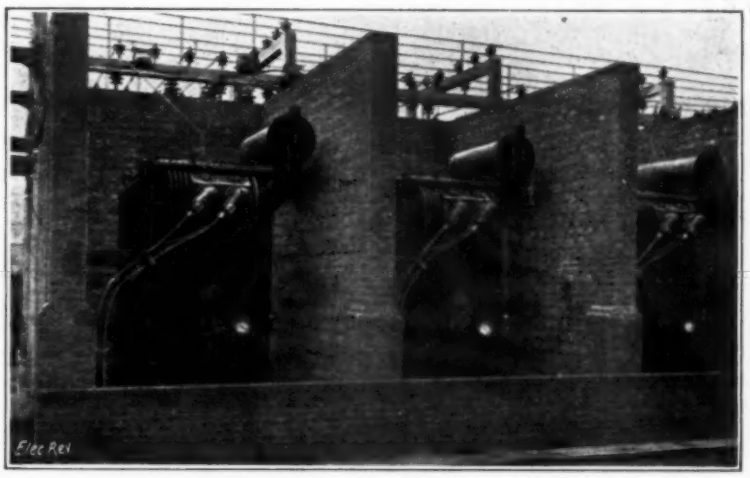


Fig. 12.—Halesowen Sub-station, 33,000/5,500-volt Brush Transformers.

Fig. 13.—A Typical Section of Overhead Power Transmission Line.

All the switchgear in the station has been supplied by the British Thomson-Houston Co., Ltd. Single-core 33,000-volt cables are brought into the basement, through current transformers, and up to the main busbar floor; the gear is of the cellular type with duplicate busbars and, in the case of the generator and feeder circuits, with duplicate circuit breakers, one being alloted to each busbar. The remaining circuits which are at present only equipped with one breaker each are arranged so that the second breaker can be added at a future date without necessitating any considerable alteration. On the upper floor of the building the oil circuit breakers are erected in two rows, each corresponding to one of the two sets of busbars, which run along both outside walls on the floor below in cubicles. Above the busbars are their isolating switches and on this floor the centre bank comprises the incoming cubicles and the potential transformer cubicles which also house the mechanically-

operated circuit breaker selector switches. So far as has been practicable each separate piece of apparatus forming a hazard has been mounted in a separate compartment fitted with sheet steel doors and lined with "Uacolite" slabs. The isolating switches are all mechanically operated with mechanism arranged to operate the switches in groups of three by convenient levers attached to the fronts of the cubicles on the busbar floor; they are furnished with interlocking gear and auxiliary switches for the purpose of indicating their positions by means of automatic electrically-operated relays on the indicating panels of the control board.

The potential transformers are mounted complete with their fuses and current-limiting resistances on draw-out trucks, obviating the necessity for potential-transformer isolating switches. Current transformers on the 33,000-volt gear are of the single-turn primary type mounted in earthed metal cases and threaded over the single-core lead-covered cables, being located with the neutral earthing equipment in the basement. All current transformers on both 33,000- and 11,000-volt equipments are fitted with a special testing winding to enable load conditions to be reproduced when they are out of commission. In the control room overlooking the turbo-generator room the panels are wired with asbestos-braided wire coloured in accordance with the I.E.E. standards.

type, and the oil circuit breakers for the earthing equipment are solenoid operated from the main control boards.

The switchgear in section A comprises the 33,000-volt side of the step-down 33- to 11-kilovolt transformers (fig. 6, last week). Sections B and C of the gear are operated at 11,000 volts, section B being provided for the control of outgoing cables for local distribution, while section C controls the alternating-current auxiliaries and workshop plant in the power station; in addition to obtaining its supply through a step-down transformer from section A it can also be interconnected with section B, and l.p. distribution in the station is controlled by special switchboards; one portion is fed from two 500-kVA 3-phase transformers controlled on their 11,000-volt side by switches in section C, delivering energy at 400 volts. A d.c. board is also provided, receiving its supply from the 750-kW turbo-generator, the 750-kW rotary convertor, and from the 250-kW d.c. auxiliary generator directly coupled to each main turbine. From this 460-volt 3-wire system the lighting supply is normally taken, but in times of emergency by means of throw-over switches the principal lighting circuits can be supplied from the battery. Both in the case of a.c. and d.c. low-voltage boards the control is divided into two, the first switchboard controlling

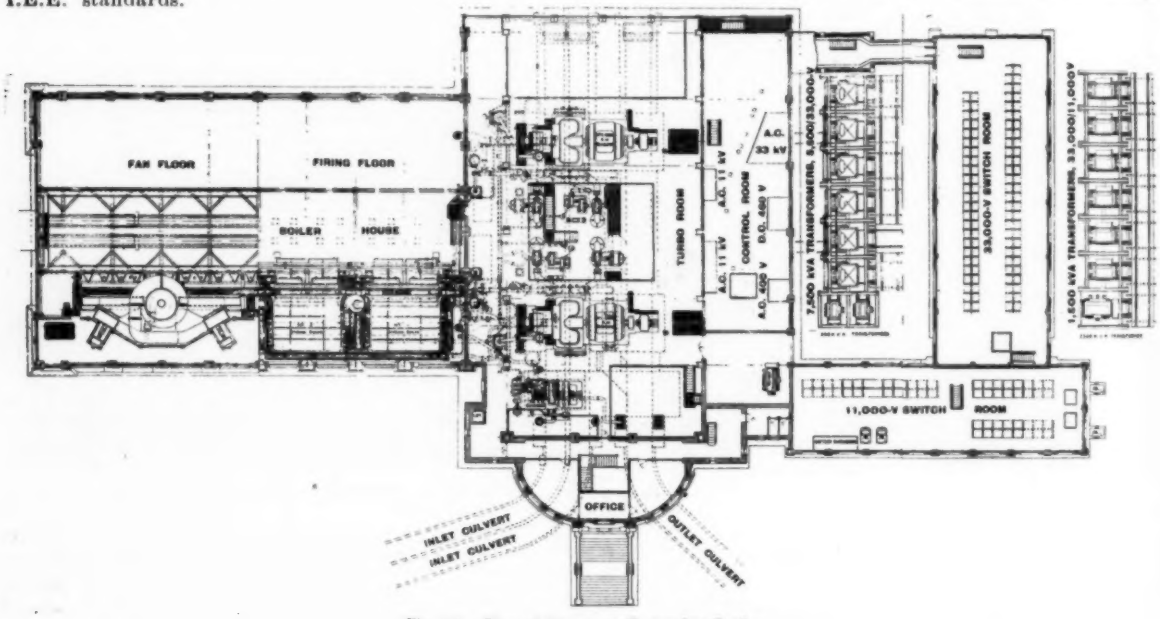


Fig. 14.—Plan of Stourport Generating Station.

The 11,000-volt switchgear on the secondary side of the 33-kV transformers controls the outgoing cables for local distribution and for auxiliary plant in the power station. It is also cellular with busbars in duplicate at the top of the structures, one set on each side of the dividing wall; below are the mechanically-operated selectors and below these are mounted the oil circuit breakers and the instrument transformers and line side isolating switches on the other side of the dividing wall. The breakers consist of three single-pole units coupled together and operated by solenoid mechanism outside the cell. Switchgear has been provided for earthing the neutral of the 5,500-volt generators and the 11,000- and 33,000-volt systems, including banks of resistances of such a capacity as to permit of the dead earthing of any phase of the system for thirty seconds without a dangerous rise in temperature while passing sufficient current to operate the protective devices of the faulty circuit. As the main transformers are star connected on the 33,000-volt side, the neutrals are employed for the purpose of earthing the system, but in the case of the 11,000-volt system the corresponding windings are delta connected and it has been necessary to provide earthing reactances for the purpose of obtaining a neutral point, of the oil-cooled outdoor

the input and transmitting it by bus cables to the second board from which all circuits around the power station are controlled.

For operating the h.p. switches duplicate Exide batteries are situated in the basement of the switch house, each of 350 ampere-hours capacity at the five-hour rate of discharge, for which the milking motor-generator sets were supplied by Mawdsleys, Ltd.

Besides those mentioned, other contractors included British Insulated Cables, Ltd. (interconnecting cable), R. A. Evans, Ltd. (electric passenger lift), Gent & Co., Ltd. (electric clocks), Messrs. B. French (lighting and power wiring), Laurence, Scott & Co., Ltd. (motors), Brookhirst Switchgear, Ltd. (control pillars), Allen, West & Co., Ltd. (controllers), and cranes were supplied by Stothert & Pitt, Ltd., Vaughan Crane Co., Ltd., and J. M. Henderson & Co., Ltd.

For the sub-station at Halesowen, which is equipped with B.T.-H. switchgear and as fig. 10 shows is of the outdoor pattern, and that at Oldbury, which are connected to the Stourport generating station by 33-kV underground cables, the Brush Co., has supplied two banks of single-phase 25-cycle, 33,000/5,500-volt transformers, each of 7,500 kVA capacity, and fig. 12 shows one of them assembled in their outdoor cubicles.

In addition to supplies furnished by underground cable to the industrial portion of its area, represented by the southern part of the Black Country, the company has constructed many miles of 11,000-volt 3-phase power lines carried overhead on wood poles, and similar low-voltage distributors in the more rural districts. There are over 100 miles of such standard lines in south Worcestershire and Shropshire, of which fig. 13 is a typical representation; some of them have been built to operate at 66,000 volts.

Villages on either side of the line routes are supplied through step-down transformers. For the 3-phase, 25-cycle, 11-kV lines stranded bare copper 0.1-sq. in. conductors are used spaced 3 ft. apart in the case of single-circuit lines and 2 ft. 6 in. in that of double-circuit lines, the maximum spans being 240 ft. and 300 ft. respectively. Single "A," and "H" type creosoted red-fir poles are employed with Buller pin type and double-link strain insulators. As a safety precaution galvanised steel wire is erected underneath the line wires and connected to four earthing bars per mile throughout.

The expenditure in respect of land, buildings, machinery, mains, and other equipment, including interest during construction and the cost of special Acts and Orders, amounted to approximately £2,500,000. In addition to the new plant, the company has a large station at Smethwick and another at Redditch; it operates the supply section of the Kidderminster and District Electric Lighting and Traction Co., Ltd., and the power stations of the Halesowen Lighting and Traction Co., Ltd., the Tewkesbury Electric Light Co., Ltd., and the Ludlow Electric Light Co., Ltd., besides being associated with the B. & M. Joint Committee of Electricity, Tramways and Motor-Omnibus Undertakings, its system being interlinked with them and also with that of the Birmingham Corporation. The company has undertaken the standardisation of frequency in the western portion of its area, but it is interesting to note that both its new station and that of the Birmingham Corporation at Hams Hall, which will no doubt be "selected" by the Central Electricity Board for its national scheme, are equipped with 25-cycle a.c. generating plant.

Portable Radio Receivers.

Some Features of Modern Instruments to which the Trader's Attention is Directed.

By PAUL D. TYERS.

DURING the past year very considerable progress has been made in the design of portable broadcast radio-telephone receivers. Until recently only a small proportion of sets of this pattern were really efficient, but this season there is a surprising number of new and really good instruments. The trade as a whole is making a considerable feature of a summer sales campaign, and, accordingly, retailers would be well advised to consider the sale of portable receivers really seriously.

The capabilities of portable receivers are somewhat limited, which is a point the trader would do well to impress upon his clients. The "pick-up" of a small frame, or indoor, aerial, compared with that of even a moderately efficient outdoor aerial, is exceedingly small, and the public, being accustomed to the normal type of aerial, is rather apt to overlook this fact. Of course, it is possible to obtain excellent results with a small aerial, provided that considerable amplification is employed, which must necessarily increase the complication and cost of the apparatus.

Portable receivers can broadly be divided into three classes: (1) really lightweight portable sets, (2) sets intended for reception from the London and Daventry stations only, and (3) comparatively complicated and heavy multi-valve sets, usually working on the superheterodyne principle, which are capable of receiving from great distances. The very small portable sets, which are frequently enclosed with all batteries and even the loud-speaker in a leather attaché case, may be said to be truly portable; the other sets are also certainly portable, but to a more limited degree. When considering the purchase of a portable set, the probable use to which the client will put it should be borne in mind: a man who owns a motor-car is not likely to trouble very much about the size or weight of the set, but it is no good suggesting a set of this description for the man whose means of conveyance is the train, motor-'bus, or bicycle. One very good attaché-case portable receiver is provided with headphones only, although it will work a small loud-speaker satisfactorily at short range; others incorporate a loud-speaker in the lid, and give satisfactory loud-speaker results when reproducing the London and Daventry transmissions, whilst still others are built into a wooden case and provided with a leather carrying strap. Several of the larger firms are marketing portable sets also, some of which are made in two portions: the set itself is in one carrying case, and the amplifier and loud-speaker in another, which, perhaps, rather limits the portability of the apparatus.

The greatest obstacle encountered when attempting the production of a portable set designed to be as efficient musically as the ordinary type is the provision of the necessary power. Most portable sets utilise fairly small valves, and the size and weight factor necessarily limits the size of the high-voltage battery which can be used. If the loud-speaker type of portable set is to be worked so that it will give reasonably distortionless reproduction, it means that a heavy demand will be made upon the anode battery, which will constantly need replacing owing to its small size.

Since portable receivers are fitted with frame aerials, the high-frequency side of the receiving circuit is less highly damped than in the case of a set used with an outside aerial. This usually means that the set is slightly more difficult to stabilise, particularly in the case of a multi-valve receiver. For this reason it is advisable that only the valves recommended by the makers should be used; some valves, of course, have larger inter-electrode capacities than others, or amplify to a greater degree, and makers usually recommend the valves which particularly suit their circuits. Any attempt to substitute other valves, or, perhaps, cheap ones, may make a vital difference to the functioning of the apparatus, and it is quite conceivable that the performance of a really good set might be very materially limited by so doing; accordingly purchasers should be reminded that it is advisable to examine and probably replace the battery at more frequent intervals than might possibly be imagined to be necessary. The same might be said of large-sized dry cells if they are fitted for supplying the filament current instead of an unspillable type of accumulator; in the writer's opinion, the unspillable type of accumulator gives greater satisfaction than a large-capacity dry cell. The difference in weight is not likely to be very considerable.

Recent Lighting Installations.

Electric lighting schemes for the new Indian Legislative Assembly, Delhi, and the Church of St. Mary the Virgin, Ashford, embodying cornice and flood-lighting respectively.

THE interior illumination of churches and public buildings, where beautiful architecture is a predominating feature of the structural design, usually presents problems which are somewhat outside the province of ordinary installation work, each case bringing its own peculiar difficulties. That such problems can best be dealt with by electric lighting is nowadays evident, and in this connection the following particulars concerning two electric lighting schemes recently carried out are of interest.

One is that at the new Indian Legislative Assembly (Indian House of Commons) at Delhi, where the first essential was to provide good general lighting without shadows. This has been done very effectively by means of cornice lighting, which also gives a very impressive tone to the surroundings, as indicated in figs. 1-3.

Fig. 1.—Indian Legislative Assembly, Council Chamber.

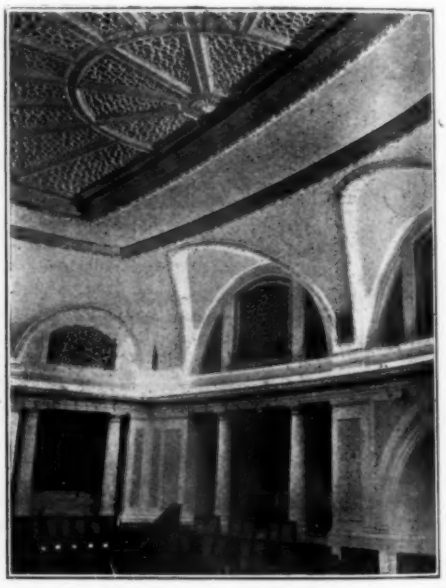


Fig. 2.—Council Chamber Walls and Ceiling.

The illustrations are reproductions from untouched photographs which were taken after dark by the light from the cornice system only.

Fig. 1 shows the interior of the council chamber. The beautiful stone fretwork ceiling of this room is brought into prominence at night time by the artificial lighting, as indicated by fig. 2. The interior of one of the Committee rooms is shown in fig. 3. It will be seen that the illumination of the ceiling is absolutely uniform. In addition to the foregoing, the Chamber of Princes, the Council of State, and the library, which has a dome of 90 ft. diameter, are all illuminated on the same system. "Emvee" cornice reflectors, supplied by Messrs. Metro-Vick Supplies, Ltd., are installed throughout. They are specially designed to overcome the streaky effect which is sometimes produced by cornice lighting.

The average service illumination on the tables and desks is 4 ft.-candles, the installed wattage being 45 per foot run of cornice. Each reflector is 13 in. long, and is fitted with two 30-W vacuum lamps in a twin holder served by one pair of terminals, thus reducing the wiring to a minimum. The wire is brought out at the back of the reflector, a convenient wiring channel being cut in the concrete. A strip of corrugated mirror runs the whole length of the front of the reflector and serves a double purpose. It spreads the light laterally so that patchiness from the individual lamps is obviated, and it reflects the light in the correct direction to give a uniform illumination on the ceiling above. The mirror is coated with pure silver and heavily backed with electrolytically deposited copper. It is claimed that the surface remains permanently bright and is unaffected by climatic conditions. Each section of the troughing can be removed independently. Clear cover glasses are provided to prevent dust accumulating in the interior of the reflector, and to facilitate cleaning. The reflector is designed to be suitable for a small cornice.

The installation was carried out by the Public Works Department under the direction of Sir Herbert Baker, A.R.A., the responsible architect for the premises.

The second installation is that at the church of St. Mary the Virgin, Ashford, where the architecture is a combination of the decorated and plain perpendicular styles, with some traces of Norman or early English. It was decided that the system must serve the dual purpose of providing adequate light for the congregation and bringing out the structural details of the ancient pile. In this connection the vicar, the Rev. Hy. Blackburne, D.S.O., consulted Capt. A. Mayne, M.I.E.E., who, in collaboration with the Illuminating Engineering Department of the General Electric Co., Ltd., drew up a scheme for flood-lighting the chancel, nave, and transepts by means of "Gecoray" flood-light projectors equipped with 150- and 200-W white gas-filled lamps.

The lighting of the nave, fig. 4, is carried out by means of these units installed at the clerestory level, nearly 40 ft. from the floor, each being focused by means of adjustable brackets attached to the transverse beams at suitable angles to light the pews on opposite

sides of the nave. The effect is an absence of glare or dazzle in the eyes of the congregation, yet a beautifully soft illumination of even intensity renders, it is claimed,

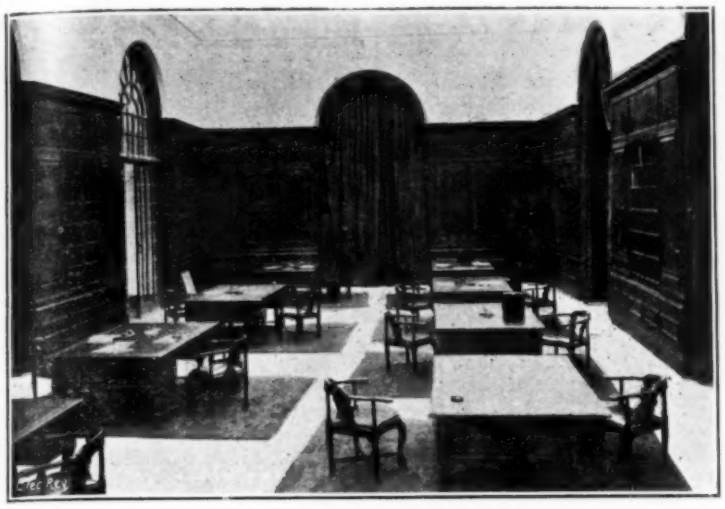


Fig. 3.—Committee Room at Indian Assembly.

the smallest print legible in the pews. The choir stalls are illuminated on the same lines as the nave, the richness of the architecture and carved woodwork being brought out to the fullest extent.

The lighting of the chancel and reredos, fig. 5, has been accomplished by installing flood-light projectors on the eastern side of the main chancel pillars. Three "Gecoray" projectors, equipped with 200-W white gasfilled lamps, are neatly fixed to each pillar, out of sight of the congregation, and focused at suitable angles; the result is a particularly uniform light on the altar and reredos. The north and south transepts are illuminated in a similar manner to the nave, the

Fig. 4.—Church of St. Mary the Virgin, Nave Lighting.

flood-lighting of the "Smythe" monument in the south transept being pleasingly effective. Two flood-light projectors, equipped with 150-W lamps, are installed on the top of the rood to illuminate it and the richly-decorated roof.

The gallery illumination called for special consideration, as it was there necessary to provide a separate system; this was also the case for the seating accommodation underneath the gallery, running parallel with the nave In the upper chamber are installed specially designed spun-aluminium "Gecoray" reflector units fitted with glazed "Morocco"-pattern diffusing glass doors, each equipped with 150-W lamps. Below, where the roof slopes inwards towards the nave, similar units of copper of octagonal design are installed. These are fitted with 150-W white sprayed lamps and provide particularly even and well-diffused illumination.

Messrs. Hayward & Co., local contractors, were responsible for the installation, which was carried out under the personal supervision of Mr. G. Dowling, and they are to be congratulated on the particularly praiseworthy manner in which the work was executed. Thanks are also due to the vicar for the facilities granted for securing the photographs which we reproduce.

A very interesting example of up-to-date electric lighting is the installation recently completed to provide efficient and uniform illumination for two hard tennis courts for the employés of Messrs. Cadbury Bros., Ltd., at Bourneville. Fifteen B.T.-H. "Dispersa" lanterns, each fitted with a 1,000-W Mazda gasfilled frosted lamp, have been installed. They are arranged in three lines of five lanterns each, one line on each of the outer sides of the courts, and one between the two courts, no units being suspended over the courts themselves or behind the service lines. The centre row of lighting units is mounted 30 ft. high, and the two side rows 24 ft. high. The side units are tilted at an angle of 10 deg. towards the centre of the courts. The installation work was

Fig. 5.—Illumination of the Chancel and Reredos.

carried out by the electrical staff of Cadbury Bros., to a specification prepared by the British Thomson-Houston Co., Ltd.

According to information obtained from the players, no glare is encountered during play, even when playing very high strokes, and the installation is in every way satisfactory.

Ideal Electricity Supply.

The importance of high Load Factor, and a method of attaining it by heat storage during light-load hours.

By GEO. WILKINSON, Harrogate.

THE forward movement for the development of national electricity supply has received official recognition and stimulus by the passing of the Electricity (Supply) Act, 1926, which is now part of the law of the land. The Act paves the way for shutting down uneconomical generating stations and the substitution of modern works equipped with the most economical generating plant obtainable. These new stations, wisely placed and provided with well-designed e.h.p. transmission lines and distribution networks, should give advantages in the shape of lower costs of production.

By far the more effective method of producing economy, however, lies in increasing the load factor of every generating station by eliminating the long periods of each twenty-four hours when, at present, they are—with few exceptions—working on extremely light loads at a dead loss to the undertaking. These daily losing periods have to be set against the remaining periods of heavier load, with the result that the average tariffs to-day are abnormally high.

Turn these periods of light load into periods of heavy load and the whole outlook of electricity supply will be radically improved.

Such a change, if it can be accomplished, will not impose any additional burden on the business in salaries, wages, or capital charges in the generating station. The only increased expense will be the extra amount of fuel consumed—plus a negligible item for slightly more oil and stores. Therefore these extra units can be sold at fuel cost plus a reasonable profit thereon, say of thirty three and one third per cent.

We can get a clue as to the method of achievement by considering the gas undertakings of the country. Where would their profits be, and what would the supply tariff be, if they worked on the same method as obtains to-day in the electrical world? They would at once have prohibitive outlay in the provision of additional retorts, to be put in and out of commission as the demand for gas rose or fell. Such a method at once provokes ridicule, and everybody recognises that the whole commercial success of the gas service lies in the making of gas at an average rate and storing the amount not required at any particular time in gas-holders until the time arrives when there is a heavier demand. Thus the rate of manufacture is an average one while the demand is a fluctuating one. Unlike electricity supply, the economy of production is maintained at a high value by average production in retorts working at high efficiency and the levelling-up between supply and demand by a reasonable amount of gas storage.

When electrical engineers are wise enough to imitate the gas engineers in this particular, the dawn of really cheap electricity will come. The object of the writer is to indicate some methods whereby this desirable end may be achieved, at least in a substantial degree.

It is true that there are no methods known to science to-day which enable large accumulations of electricity to be made and drawn upon excepting under prohibitive terms of capital outlay and storage loss. In the case of gas, a few holders furnish the means for effective and economical storage which is denied to electricity works.

It is, however, open to the electrical interests to secure a close parallel advantage by storing the electrical energy during periods of small demand in the shape of heat, the heat so stored being arranged so that it can be usefully employed the next day instead of taking the equivalent amount of energy from the generating station during the periods of heavy demand. Thus a double advantage is to be realised; first, the efficient employment of machinery during long periods, which are now hours of small and uneconomical demand, by converting them into periods of heavy and efficient demand by means of heat storage. Secondly, the reduction of the amount of generating plant required for the heavy-load period, due to the fact that the heat storage already effected serves during the heavy-load hours to reduce the amount of generating plant required to make up a given aggregate output.

No scheme for effecting this improved condition of working appears to have been entertained hitherto, and the economy realisable thereby has yet to be recognised. It is true that gas storage is easily effected within the gas works' domain, whereas heat storage in connection with electricity supply must necessarily be effected in smaller amounts on the premises of the consumers; nevertheless, the economies in each case are comparable, although the balance of advantage must remain with gas, because in the other case there is a change in the form of storage which in itself means loss.

Some attempts have been made to average up the electrical loads by offering current during the light-load hours at reduced cost, and allocating the proper times for the respective supplies by means of time switches. This method cannot, however, in any event meet the case. For a full realisation of the possible benefits, the supply taken during the, at present, periods of light load, must be conserved until the periods of heavy load and vended during these periods, thus reducing the maximum load imposed upon the generating station. In this way there will be two valuable gains, one, due to a good load factor at all hours and the other, due to the reduced top-load. The latter means less capital outlay for generating plant, both in the boiler house and the turbine room, together with a less costly building for its accommodation.

If trouble be taken to study the requirements of the all-electric house and, to a less extent, of the all-electric office, it will be found that from 70 to 75 per cent. or thereabouts of the electricity taken is required for the furnishing of low-grade heat, *i.e.*, for hot water and room heating. Such low-grade heat can be efficiently and cheaply stored during the hours of low loads and used next day during the hours of high demand upon the electricity works. As already shown, this out-of-hours supply can be given on perfectly sound commercial lines at coal cost plus a reasonable profit, and on these terms it is within the capacity of the householder to buy it for heat storage purposes.

The author suggests that the question of efficient super-stations should not be allowed to monopolise the attention of technical and commercial minds, but that consideration can with greater benefit be given to the aspect of the problem that he has ventured to set out.

It is essential, inasmuch as the sale of electricity at cheap rates is involved, that the cost of the extra equipment on consumers' premises and especially the extra outlay imposed on the generating authority should be kept low.

In a future article the author may have an opportunity of describing some details and equipment which have been designed to meet the new order of business herein outlined.

One factor in the proposition has already been described in the Press under the designation of the "dispensable circuit," but the eventual development will undoubtedly be the provision of what, for want of a better name, the author has designated a "change" circuit. This will be an alternative network of limited extent supplying a variable amount of electrical energy at a low rate per unit for heat storage purposes.

The amount of current supplied through this network will be the difference between the maximum load on the generating station and the demand for the time being on the ordinary supply network.

During the period of top load the supply to the "change" circuit would cease entirely. Moreover, the "change" circuit will suffer no disadvantages due to fluctuations in either pressure or current.

The more the possibilities of such a network are considered the better for both the industry and the community.

The Foreign Agency.

Some Points which are often Overlooked in Overseas Arrangements.

By A. J. SMITH.

THE perusal of any considerable number of foreign agency agreements of different engineering firms points very clearly to the advantages which would be derived from some method of pooling experience through the medium of a central organisation, as well as the need of a generally-accepted type of agency agreement capable of meeting the reasonable requirements both of a normal manufacturer and an average overseas agent. Although the greater portion of the overseas trade of this country in engineering material is probably transacted under some form of sole agency agreement or other, and there must be thousands of such agreements in existence, many of them show a distinct lack of provision for some of the most ordinary happenings which arise under such arrangements, and which could in most cases have been readily settled in the preliminary negotiations. Nothing is lost in facing the fact that the interests of the parties are in certain contingencies opposed, and when such cases are viewed in the initial stages as abstract propositions, it is far easier to agree upon the procedure than it is when an actual incident has occurred, and a decision results in one party being a loser.

The Description.

The first point which calls for consideration is the actual word employed to describe the second party to the agreement. Though the use of the word "agent" in this connection has attained the sanction of commercial usage, it is really a misnomer, as is readily apparent when the wide legal powers attributed to an agent are considered. The party of the second part, or selling agent, in the more restricted commercial acceptation of the term is either a distributor who possesses the sole buying or importing rights of a particular make of article for a defined territory, or alternatively he may be a sole representative in that territory for the purpose of introducing the goods to the notice of buyers. In the motor-car industry, such words as "distributor" and "sole concessionaire" are beginning to be used for designating the duties and powers of such an importer, although they are American terms which have not yet attained general acceptance in commercial phraseology. While in most agreements, and in these notes, the word "agent" is still used, it is becoming increasingly common for an extra clause to be inserted in the document which expressly disclaims the full legal meaning of the word, and defines the exact duties and powers which attach to the term.

Exclusive Arrangements.

Another question which frequently arises relates to the exclusive nature of the arrangement on both sides. The agent undertakes to deal only in goods of a particular class made by one manufacturer, and the latter transacts all business for a certain territory through the agent there. In the complete observance of this reasonable stipulation, however, the manufacturer works under certain difficulties which are not always apparent to the agent who may not be fully acquainted with the ramifications of export trade apart from that concerning his own territory, and these difficulties render certain exceptions necessary.

It is not a difficult matter to refer to the agent all inquiries and orders received *direct* from an agency territory for attention, but a very large volume of export business comes to the average British manufacturer through merchant-buying houses in England, the makers often being to a great extent unaware of the exact destination for which the goods are required. The policy of first inquiring the destination in all such cases, and refusing to quote if the goods are intended for an allotted market, which is the plan often seriously advocated by agents when the position is explained to them, is open to certain objections. In the first place, the merchant house may already be a regular buyer, fully conversant with current prices, and therefore not needing to put through the usual inquiry before ordering. In the next place, a merchant house does not always care to name the destination in the inquiry stage, and further the manufacturer who seeks to take up the attitude of picking and choosing which inquiries he will quote for and which he will refuse, is not likely to have such opportunities presented to him more than once or twice. As a consequence of refusing to quote a merchant house for comparatively unimportant markets such, for instance, as Turkey and Bolivia, the maker may, as a consequence, miss altogether the much more important business which the same merchant may have to place for other destinations. The agency agreement should therefore always contain a provision that the manufacturer may continue to do business through the merchant houses of this country, even if it is necessary to pay a small commission upon such trade.

Names of Users.

It is not an unreasonable request that the manufacturer should be kept informed of the names of the ultimate customers to whom his goods are sold through an agency, in such trades where the procedure is possible, though, generally speaking, there is a disposition on the part of many agents to keep the manufacturer in the dark as much as possible. As a consequence, there are instances of makers, after doing a regular trade for a number of years with a certain territory, who, following a rupture with the agent, are left entirely ignorant of who their customers have been or the terms upon which the business has been done. It is therefore advisable for the agreement to provide for the name of the ultimate purchaser to be disclosed, and for regular efforts to be made to ensure the arrangement being adhered to.

Government Orders.

Another frequent point of difference between the principal and the agent arises in connection with certain business of the class similar to that regularly placed in London by overseas railway companies, by

the Crown Agents, by large foreign shipyards financed by British capital, and occasionally by large armament firms abroad. Much of this class of business originates, and is settled entirely in this country, without any special reference to the territory to which it is to be sent. If there is any definite work done by the agent in originating such business, there are not many manufacturers who would object to including it in the ambit of the agreement, but where it originates and is settled entirely between the maker and the buyer in this country, there is a not unnatural disposition in manufacturing quarters to regard it as being outside the scope of the arrangement. It is a point in any case which should be discussed and settled when the terms of the arrangement are being negotiated, and, in addition, the agent would be acting in his own interests to keep the makers advised upon the details of any propaganda work he may undertake with establishments of the type described, and where the business may ultimately have to be referred to authorities in London for settlement, rather than waiting for the *fait accompli* of an order before making a claim.

In connection with agency agreements generally, it is an unfortunate fact that there is not enough co-operation between manufacturers in a particular trade, either in regard to standardising conditions or pooling the results of experience. In a somewhat similar field, the electrical industry has led the way by providing an agreed set of conditions of sale for various classes of export business, and what has been done in the electrical industry in this respect could be paralleled in other exporting trades by the provision of a standard form of agency agreement which, if it could also be passed by an organised body of importers in some overseas market, would be the means of striking a happy medium between conflicting interests.

The Lay-out of the Contractor's Shop.

By ERIC N. SIMONS.

THE interior of the shop is one of the most important factors in electrical retailing. The deep gloom common to many electrical dealers' shops must be avoided. Sometimes it is caused by the heavy character of the stock, but as a general rule it can safely be ascribed to inefficient window-dressing, poor lighting, and faulty arrangement of fixtures. Inefficient window-dressing means that the articles in the window are so tightly packed, and the window itself so crowded with opaque objects, that very little light gets into the shop from outside, even on the sunniest day.

Bright and cheerful shop interiors put people into a more generous frame of mind. They feel more disposed to buy optimistically. Artificial light employed in day-time is not only expensive but also depressing. It makes the assistants look pallid and the shop less attractive.

Bad lighting increases the gloom. In one electrical shop known to the writer, all the upper windows, which were put in originally to throw light towards the back of the shop, were covered with black paper, so that something could be done to them outside. Naturally, the gloom was fierce. It is often the case that slight structural alterations would vastly improve the lighting of a shop. For example, an extra skylight or window, costing comparatively little, would soon repay its cost in increased sales. Some retailers imagine that because they deal in electrical appliances, they ought to have electrically lighted shops both day and night. No fallacy could be greater. Electric light is for night, not for the day, and the wan appearance it has in the latter instance tends to damage rather than help its appeal.

Bad stock arrangement can easily be altered. Piles of bulky objects or stacks of big boxes and cases, placed too near the source of light, cast deep shadows, exclude sunlight, and make gloomy corners where none is necessary.

Overcrowded floor space is another great fault of many electrical retail shops. Sometimes one has literally to tiptoe one's way to the counter, stepping over this and that and the other package, evading packing cases that ought not to be there at all, and often going in fear of catching a big pile of boxes with one's elbow and bringing it down with a crash. Again, many retailers leave only a few inches of clear space on their counters, so that the customer burdened with gloves, stick, handbag, other parcels, or whatever it may be, is unable to rest them anywhere while negotiating or examining goods. These things make shopping uncomfortable, and the electrical retailer's business is to make shopping easy. Generally, this condition is due to under-staffing by the retailer, so that his goods are not stocked, unpacked, distributed, and so forth, as quickly as they ought to be, with the result that they are left encumbering the selling spaces.

The retailer should have some regard for the comfort of his customers. It is astonishing how few electrical retailers have chairs on which their customers may sit, if they have to wait any time. Again, many fail to afford proper facilities to their customers for the inspection of the appliances they wish to buy. Often owing to the crowded counter already mentioned there is no room to demonstrate an appliance.

Shelving by its design and arrangement affords a great deal of attraction to the shop. If oak shelving, stained dark, is too costly, stained deal may be used to advantage.

The shop floor is very important. The ordinary wooden planking covered with linoleum is not very satisfactory. It wears quickly, looks unsightly after a little wear, takes a great deal of keeping clean, and is fairly costly. Many electrical retailers are beginning to favour a polished hardwood floor, sometimes covered by rugs here and there. This wears well. Best of all, perhaps, is the rubber carpeting now being used in many shops. This quietens the shop, and so enables the words of salesmen to be better heard, and the remarks of the customer to be less costly in effort.

Efficient Drawing-Office Lighting.

The correct illumination of a drawing office presents a number of special problems which necessitate careful, scientific treatment. An installation recently designed by the General Electric Co., Ltd., and carried out by Messrs. Tyler & Freeman, exemplifies the application of such treatment. The approximate ceiling height of the offices in question from floor level is 9 ft., and on account of this the working plane is situate only about 5 ft. below the lamp filament with the fittings mounted direct on to the ceiling. The spacing was so arranged as to provide each drawing bench with right-hand, left-hand, and frontal lighting. The fittings are of the "Unalux" enclosed pendant type, made by the G.E.C., in which the 16-in. diameter glass bowl is supported by bronzed metal work, each fitting containing a single "Osram" 200-W gasfilled lamp. The fittings are equipped with standard ventilating galleries. The average intensity approximates to 46 ft.-candles; the scheme was designed to provide an ultimate average of 30 ft.-candles on the working plane. Tests carried out on a number of the drawing boards resulted in its being impossible to detect, or even to create, anything in the nature of objectionable shadows. It was proved that the finest lines could be drawn with perfect ease and precision from either the right- or the left-hand side of a set square. Altogether there are 191 lighting points, each of 200 W. 38,000 watts in a drawing office is in itself something new in office illumination. There are over 100 draughtsmen employed in these offices, which are situated on two floors.

The Institution of Electrical Engineers.

Summer Meeting at the North-Eastern Centre.

THE early contingents of the 290 members and their ladies from the various I.E.E. Centres who are participating in the summer meeting of the Institution, under the presidency of Dr. W. H. Eccles, F.R.S., forgathered on Monday evening last in the banqueting hall of the Central Station Hotel at Newcastle-upon-Tyne, to initiate the week's proceedings by meeting the Committees of the North-Eastern Centre and Tees-side Sub-Centre, whose chairmen are, respectively, Mr. J. Rosen and Mr. W. R. Cooper. The establishment of the Centre dates from 1899, and in 1912 its activities were enlarged by the inauguration of a Students' Section; the present membership is 510. The Tees-side Sub-Centre was formed in 1912, and its membership is 96.

Standing on the line of the Roman wall which was built across country from coast to coast as a defensive obstacle to the northerners, ending at Wallsend-upon-Tyne, Newcastle's distinctive name originated from the "new" castle of Norman times, as distinguished from the old castellum of Pons Aelii, the family name of the Emperor Hadrian, who visited Britain in A.D. 120, which was shared by the Roman bridge that crossed the river at that spot and the camp on the hill above. The district is to-day renowned chiefly for the winning and export of coal, naval and mercantile shipbuilding, the production of iron and steel, and ordnance, while the coast line can boast of some of the finest harbours and docks in this country. The locality was early associated with the introduction of steam traction and the development of the steam locomotive by William Hedley, Timothy Hackworth and George Stephenson, and with the invention of the Parsons steam turbine, and Sir Joseph Swan publicly exhibited electric lighting on a large scale by means of incandescent lamps for the first time in Newcastle. Although the manufacture of electrical products cannot be described as a staple industry, the production of electrical machinery and appliances nevertheless occupies a prominent position in local industry. Apart from its industrial aspect and the historical remains extant, the Centre is within easy reach of some of the most picturesque parts of the kingdom; the Northumberland coast and moors have a charm of their own, and the Durham and Yorkshire dales are perhaps too little known.

On the Tuesday morning alternative visits were paid to the Heaton works of Messrs. C. A. Parsons & Co., Ltd., and to those of Messrs. A. Reyrolle & Co., Ltd. Although the late Alphonse Reyrolle established a small workshop in London in 1886, it was not till 1901 that the first works were built on the present site at Hebburn-on-Tyne. Beginning with two or three small single-storey buildings, they grew apace until in 1922 they occupied 150,000 sq. ft. of floor space on a site of 5½ acres which was nearing its economic limit. Accordingly, it was not only decided to equip a fresh factory, but to take the opportunity thus afforded of thoroughly modernising the existing one. An already acquired site of 4½ acres not far from the Hebburn works, which had been used as a recreation ground for the workpeople and staff, was laid out to accommodate all the machine tools, except the minor services incidental to the assembly of the apparatus, and this site now forms part of the ground of the New Town works; when it was built upon, a new and larger recreation ground was laid out to take its place. Fig. 1 is an aerial view of both factories.*

Fig. 1.—Aerial View of Messrs. Reyrolle's Old Town and New Town Works and Sports Ground.

The new buildings are light and airy, with provision for the safety and welfare of the workmen; they comprise nine bays, each from 200 to 250 ft. long and from 30 to 40 ft. wide, the total area being 72,000 sq. ft., with ample space available for extension to 200,000 sq. ft. when required. The machine tools installed are of modern type, and the arrangement of the bays and equipment is designed to reduce handling to a minimum, cranes having been provided for the transport of material and finished parts; a battery locomotive with a haulage capacity of 75 tons deals with inter-works traffic, both the old and the new works being alongside the London and North-Eastern Railway. An aggregate of 100 tons of metal (steel, cast-iron, copper, brass, &c.) is every week wrought into switchgear, the combined factories being capable of an output of 210,000 kW of gear per annum. At present the works provide employment for some 2,000 workpeople, engaged upon the production of metal-clad switchgear for pressures ranging up to 132,000 volts and breaking capacities up to 2,000,000 kVA. Fig. 2 shows the general arrangement of the bus-bars and sectionalising switch of the 12,000-V, 1,500-A, 3-phase, solenoid-operated, draw-out, twpe A.2 gear supplied for the South African railways.

The Company has applied strong principles to one branch of the engineering industry: the basis of its switchgear design simply consists of the complete enclosure of all fittings and conductors which would be dangerous to handle, in such a way that they are rendered inaccessible when "alive," the enclosure being of earthed metal; but merely working to a general principle would avail but little if it were not backed by thoroughness in all detail of both design and workmanship. Its work having at first been regarded as eccentric, the position to-day is that not only are metal-clad principles being extensively adopted for the largest power- and sub-station equipments in this country and

* See also ELEC. REV., January 12th, 1923, p. 59.

the British Dominions, but also that some very large American manufacturers have taken up the production of corresponding apparatus, amongst whom the Allis-Chalmers Company manufactures under licence to Reyrolle designs.

The Heaton works of Messrs. C. A. Parsons & Co., Ltd., were founded in 1889 for developing the steam turbine for land use; the first ship's turbines were constructed in those works also, but in 1898 an additional site was chosen for marine work, which was taken over by the Parsons Marine Steam Turbine Co., Ltd. In 1889 the Heaton works occupied an area of 2 acres, the original shop being no more than 170 ft. long by 50 ft. wide, and the entire staff numbered 48 all told; to-day the acreage is 18 and over 1,200 men are employed. The record of the Company is indeed one of continuous pioneering work*; the output of turbines for use on land alone (manufactured at Newcastle and throughout the world under licence) cannot aggregate less than 50,000,000 h.p., noteworthy sets being those of 20,000 h.p. at Treforest, of 55,000 h.p. at Barking, and of 70,000 h.p. at Chicago.

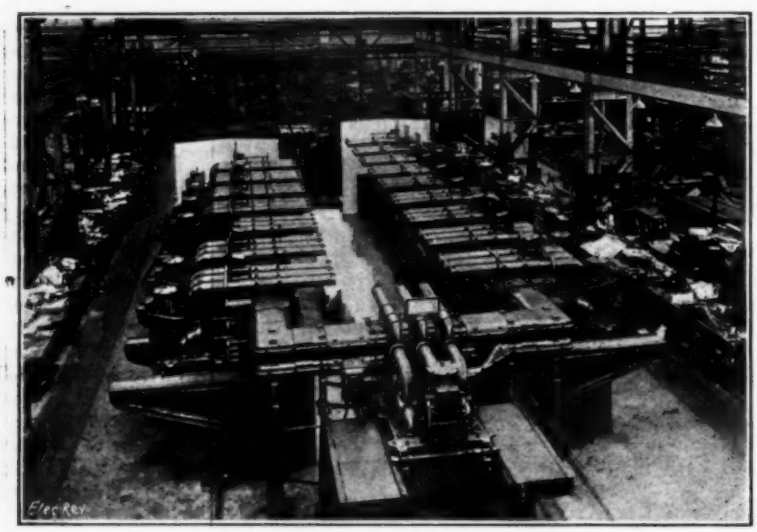


Fig. 2.—Three-phase 12,000-V Draw-out Switchgear for South African Railways.

Other products include surface condensing plant, high-speed centrifugal fans, compressors, blowers, exhausters, &c.; d.c. dynamos, low- and high-speed a.c. generators, and air coolers for the last named: the fact that 3,000-r.p.m. machines of over 28,000 e.h.p. are being constructed at present is indicative of recent development. The insulating materials are prepared from the raw materials entirely in a department specially ventilated and maintained free from dust, the stranded stator conductors being encased in insulating troughs by special machines evolved in the Heaton works. Besides the principal shops, which consist of three 385-ft. and one 416-ft. bays, two new shops were built in 1924 for the erection of electrical transformers which the Company has recommenced to manufacture. Searchlight reflectors have been one of the Company's standard products since its foundation, and in order to meet the British and Allied Government's requirements during the late war the shops devoted to their manufacture were enlarged to three times their previous capacity, which enabled the output to be increased tenfold, up to 100 mirrors per week, ranging from 10 in. to 5 ft. in diameter.

Two balancing houses enable alternator rotors to be run at 33 per cent. over-speed and turbine shafts and disks 50 per cent. above normal. The various shops are interconnected by full-gauge railways, electrified on the overhead d.c. trolley-wire system, power being mainly purchased and delivered to two works sub-stations which transform the 5,750-V a.c. supply to 440 volts for shop services: d.c. is also available for driving motors and lighting from motor-generator sets, whilst a reserve d.c. supply is obtainable from three condensing turbo-generators in the test house, which can also be run as back-pressure machines to feed steam to the works for heating purposes. Automatic telephones are employed throughout the establishment, and a works school was commenced in 1919 as a development of the apprentice scheme, the custom of the Welfare Department being to pass every "trade" apprentice through the school and to encourage further study at evening classes and at college by financial aid.

At mid-day the whole party assembled outside the Armstrong College, where an official photograph was taken, and after luncheon at the Grand Assembly Rooms, Barras Bridge, those who had visited Messrs. Parsons's works during the morning toured Messrs. Reyrolle's, and *vice versa*, tea being served at both works by the respective Companies. In the evening there was a civic reception by the Lord Mayor (Councillor A. W. Lambert, M.C.) and the Lady Mayoress, dancing being indulged in to a late hour.

(To be continued.)

* ELEC. REV., January 26th, 1923, p. 130.

Metal-Clad Draw-out Switchgear.

Another Point of View, with Reasons.

By J. R. WILKINSON, B.Sc.Tech., A.M.I.E.E., A.M.C.T.

IN his interesting, though perhaps somewhat biased, article appearing in the May 27th issue of the ELECTRICAL REVIEW, Mr. Thomas Carter comes to a number of conclusions which to my mind do not by any means represent the full facts of the situation. From his opening paragraph it would appear that he has only recently come into close touch with the various types of metal-clad switchgear. He states himself that this is a question where experience counts enormously, and I venture to suggest that the experience of a large number of operating engineers does not bear out his contentions. As personal opinions are of very little weight without a backing of solid reason, I propose to deal with the points raised in Mr. Carter's article, in the order in which they occur.

Horizontal-type gear is dependent on its rails for guidance and alignment, and it is more difficult to obtain perfect contact where the whole weight of the moving part is on the guide than where it is allowed to centre itself freely about a vertical axis. The lifting gear on the vertical type is extremely simple, is an integral part of each unit, and serves the dual purpose of isolating the breaker and lowering the oil tank. With horizontal gear recourse has still to be

had to the despised vertical principle for removing the tank or the complete breaker, but in this case it takes the form of a cumbersome separate lift. Surely it is preferable to have one mechanism rather than two, especially when the latter only permits one switch to be inspected at once. With regard to the point that two motions are required with vertical gear, this is only the case when the oil tank or switch is completely withdrawn. It is not necessary for routine inspection.

I agree that, so far as practicable, switchgear should be made for man and not *vice versa*. Its primary function is, however, the control of electrical energy, and I imagine that most engineers will agree that the vertical type best combines these functions. The point about orifice inspection is immaterial, as with properly constructed gear there is hardly ever any necessity to do this. When necessary, it is almost as easy with one type as the other, and it is far easier to leave stray nuts, &c., in the horizontal spouts.

Strong exception must be taken to Mr. Carter's statement that plug changing is the simplest and most rapid method of busbar selection. On the contrary, it is one of the crudest, and is quickly becoming obsolete. Change-over cannot be made without shutting down the circuit and isolating the breaker, and it is difficult, complicated, and expensive to provide an interlock to prevent two plugs only being changed over. Oil-immersed selector switches interlocked with the circuit breaker are a distinct advance, but do not allow change-over under load without the use of a separate bus-coupler switch. With double circuit breakers change-over is effected with the utmost ease and rapidity, and complete control is centralised in the control room. A whole station can be changed-over from one set of bars to the other in far less time than is taken by transferring a single unit using the plug method. Moreover, a separate coupler is not essential, and the second breaker acts as a spare should the contacts of the first be damaged by a "short." More than one important operating engineer was initially prejudiced against metal-clad gear, due chiefly to the lack of facilities for busbar selection, but has been converted by the double-breaker principle. On the rare occasions when it is necessary to change the complete circuit breaker the advantage again lies with vertical gear, as the breaker has to be lowered only and not racked out and then lowered.

The lifting mechanism on the vertical type is sufficiently robust to support the circuit breaker in the operating position. The additional catches or brackets are merely additional safeguards and for supporting the breaker top plate in the "isolated" position when it is desired to lower the tank only. With both types the operating gear is equally accessible, but the arrangement of the vertical type is such that this can be mounted on the fixed portion of the unit, thus eliminating auxiliary plugs and sockets and giving complete interchangeability of the fully-protected breakers.

Mr. Carter complains of the height of the cable box on vertical gear, and almost in the same breath refers to the use of basements for switchgear. I would remind him that such basements seldom have a cable floor beneath them, and all supply engineers now realise the risk of bending cable at too small a radius. This height, whilst not detracting from the accessibility of the box, enables a bend of large radius to be used.

Dealing with the question of floor space occupied, I agree that with both types it is essential to have a passage way in front of the units. On the horizontal gear, however, the brackets which support the breaker in the isolated position project permanently into the passage, which has to be widened accordingly. On the vertical gear the circuit breaker is merely drawn out temporarily and then removed. Moreover, for contact inspection on vertical gear the breaker is not withdrawn, but only lowered. This will probably occur a hundred times for one removal of the complete breaker.

One of the great advantages of vertical-type gear is the shortness of the conductors and the minimising of the "loop" formation, thus giving great robustness under short-circuit conditions. The circuit breaker is firmly clamped between the lifting mechanism and stops on the fixed portion to prevent movement under shorts. All forces on the fixed portion are direct as against the cantilever action on the spouts and bushings of the horizontal gear. In this connection I cannot do better than refer to a paper read by Messrs. Sporn and St. Clair before the American Institute of Electrical Engineers early this year. Fig. 17 of this paper shows the destructive effect of these forces on the busbars, rather contradicting Mr. Carter's conclusions.

The question of the methods of bus selection on duplicate busbar systems has already been dealt with. It should, however, be pointed out that with double breakers the interlocks are far simpler and more robust than with a separate oil-immersed isolator. I am afraid Mr. Carter's remarks about two breakers in a common tank indicate lack of experience on this gear. It has been conclusively proved by short-circuit tests of high capacity that if the two busbars of such a unit are connected to two unsynchronised supplies, heavy shorts may be broken on one without in any way tending to spread to the other. These tests were carried out at 33 kV, under the worst possible conditions. It is also interesting to note that many systems have been operating successfully for a considerable time, in which a separate source of supply is maintained in each set of busbars, and the double breaker selects the supply to which the circuit shall be connected.

Coming to the question of the comparative weather-proofness of the two types of gear, I agree that the problem is not so much the danger from dripping water as the humidity of the atmosphere and sweating. It appears to me that it is equally difficult to solve this with either of the types in question, and that only a hermetically sealed chamber will absolutely prevent the ingress of moisture.

The experiences of operating engineers carry great weight in matters of this kind, and accordingly it is interesting to note the following comments of an operating engineer of a large station where vertical type gear has been installed for some years. In his view the weight to be handled and supported has not presented any difficulty in operation, and it is simply a question of suitable mechanical design. Isolation and removal of the oil tank is rapid and convenient in operation, and there is a saving in time due to special tank-lowering tackle being dispensed with. The interchanging of the oil circuit breaker is readily carried out. The space required is a minimum, and far fewer horizontal units could be accommodated. The question of being able to change-over from one set of busbars without interrupting the supply is of the utmost importance to the operating engineer. Although the switch house in question is not a particularly dry place, no trouble has been experienced due to moisture; the insulators have been in continual service for two years without cleaning, and were remarkably clean at the end of that period.

In conclusion, I cannot agree that the fact that the pioneers of metal-clad switchgear still hold to the horizontal principle indicates any superiority of principle. It is well-known that the manufacture of a range of metal-clad switchgear entails an enormous outlay on jigs and tools, and there is a natural reluctance to make so drastic a change even where a better principle is involved. One large manufacturer of metal-clad gear actually commenced with the horizontal type and then abandoned it for the vertical gear.

Metal-clad gear is now being developed on the Continent and in the United States of America, and it is significant to note that in these places the tendency is towards the vertical principle.

I trust that I have made it clear from the above that the argument is by no means as one-sided as Mr. Carter would have us believe, and that taking all things into consideration the balance undoubtedly lies with the gear designed on the vertical principle. It is extremely probable that the future will see the wholesale development of the vertical type of switchgear.

D

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The Contractors' Convention.

The second annual convention of the E.C.A. Allied Associations is to be held at Scarborough from Wednesday next until the following Friday. A very successful gathering is anticipated; the registrations up to the end of last week were in excess of those for last year's conference at Brighton.

Demand for Higher Australian Tariffs.

A Sydney correspondent of *The Times Trade and Engineering Supplement* states that at a recent meeting of the Chamber of Manufactures, a resolution in the following terms was adopted:—"The Electrical Manufacturers' Section views with alarm the protracted delay in dealing with requests for effective tariff protection, and respectfully urges the Council of the Chamber to use every effort in its power to expedite the tabling in Parliament of the Tariff Board's reports already submitted to the Minister, and the early reference to the Tariff Board of all outstanding applications." The Chamber reports that only nine matters which it has asked to be referred to the Tariff Board have not yet been so referred; these include air-break ironclad switches, switch-fuses, and circuit breakers.

Engineering Wages in Australia.

The Australian engineering trade unions recently made an application to the Commonwealth Arbitration Court for the application of the 48-hour week wages to the present 44-hour week. The employers made a counter-application for an entirely new award which would recognise a bonus or payment-by-results system. Mr. G. B. Clerk, managing director of the English Electric Co. of Australia, Ltd., in his evidence, said that Australian electrical manufacturers could not compete with overseas manufacturers who had lower wage rates and a wider market. His company had made over 200 traction motors and had lost at least £47 on each of them. They had, therefore, abandoned the manufacture of the machines until conditions altered. He held that the most satisfactory method of payment in the engineering industry was to guarantee a regular hourly wage and pay a bonus depending upon output.

The Importance of Argentina.

To illustrate the predominant position which Argentina holds in South America, the *Journal* of the British Chamber of Commerce in the Argentine Republic quotes a number of notable facts. It is shown, for instance, that in 1924 over half of the foreign trade of the Continent was attributed to Argentina, and in 1923 the amount of foreign trade per head of population amounted to $159 gold in the case of Argentina and only $33 in respect of the whole of the remainder of South America. The Republic had 60 per cent. of the railway merchandise traffic; 42.7 per cent. of the railways—37.7 km. per inhabitant against 29.3 km for the remainder; 45 per cent. of the telephones; and 58 per cent. of the motor cars.

The Anglo-German Industrial Conference.

Last week-end representatives of British and German industries met at Leverkusen, near Cologne, to continue the discussions opened in this country in October last. Dr. Duisberg was the host, and the British steel and engineering industries were represented by Sir William Larke and Sir Archibald Ross. Among the matters dealt with were the European steel cartel, the eight-hour day, and the re-establishment of European industry.

Chinese Notes.

The net profit for 1926 of the Pootung Electric Supply Co., Ltd., was $41,047. A total dividend of 11 per cent. has been paid. The company has a subscribed capital of $300,000.

It is proposed to broadcast music, news, &c., in Peking and Tientsin, and offices have been established to take charge of the system. Any person who desires to install a receiving set must register at one of these offices, and pay an annual fee of from $6 to $12. Importers and sellers of radio equipment also have to be registered.

The Chapei Electricity and Waterworks Co., Ltd., Shanghai, earned a net profit (including $52 brought forward) of $249,115 for 1926. A dividend of 6 per cent. was declared on the deferred and founders' shares. The capital is to be increased from $2,000,000 to $4,000,000.

British Engineers' Association.

A luncheon organised by this Association took place at the Hotel Cecil on Thursday (yesterday), 16th inst. Guests were invited to meet Sir Arthur Balfour, K.B.E., and the Rt. Hon. R. McKenna, P.C.

Unemployment.

There was a small increase (7,320) in the number of unemployed during the week ended May 30th. The total at that date was 985,500, as compared with 978,180 on May 23rd and with 1,614,210 on May 31st, 1926. The last figure was abnormal on account of the coal stoppage. The latest total includes 208,900 women and girls.

Electric Power in Industry.

Railways are the principal subject of Preliminary Report No. 14 upon the 1924 Census of Production, issued as a supplement to the *Board of Trade Journal* dated June 9th. The total value of goods made and work done during 1924 was £70,727,000. This total included:—Telegraphic and telephonic lines, works and apparatus, £1,023,000; electric lines and works, £589,000; and electricity generated for other than railway companies' manufacturing purposes, £1,046,000. The equivalent of the last figure in 1912 was only £371,000. The total capacity of electric generators at railway companies' works was 164,712 kW, as against 83,260 kW in 1907. The aggregate power of electric motors in use was 137,847 h.p., and power was purchased for 52,209 h.p. of these.

The same report also deals with other trades. It is shown that in the blacksmithing trade in 1924 there was only 13 kW of generating plant (against 60 kW in 1907). The motors in use aggregated 4,379 h.p., and power was purchased for 4,370 h.p. of these. The small arms trade did not report any generating plant (there was 981 kW in 1907), but it had in use 2,856 h.p. of electric motors. Electric generating plant rated at 1,917 kW (against 716 kW in 1907) was returned by the bacon-curing and sausage trades. There were also motors with a total capacity of 9,778 h.p. installed, and power for 7,983 h.p. was purchased.

Great Britain's Radio Exports.

Details of the exports of radio apparatus from this country during April are given in the *Wireless Trader* for June 11th. The total value (excluding re-exports) is given as £109,092, which includes valves valued at £21,746. Our principal customer was Australia, whose share is given as £27,230 (valves £8,397); this figure represents a substantial increase. The share of New Zealand—£12,444 (valves £2,087)—was more than double that of the preceding month. The chief foreign customer was Holland, which took goods to the value of £6,503 (valves £89). Although Japan remained in the second place with a total of £4,452 (valves £105) its share again diminished considerably.

The World Economic Conference.

The recently-published final report of this Conference (under the ægis of the League of Nations) surveys the whole field of finance, industry and trade and makes many recommendations. Perhaps the most important section is that relating to Customs tariffs and kindred matters. The reasons for high tariffs are examined and shown to be economically unsound; internal taxes upon imported goods are condemned; and export taxes upon raw materials are also viewed with disfavour by the Conference. Matters of more immediate practicability which are dealt with are the interchange of commercial information and statistics between countries, and "rationalisation" (standardisation and organisation).

Works Visit.

On the occasion of the summer meeting of the Institution of Mechanical Engineers at Birmingham a visit will be paid to the works of the B.T.-H. Co. at Rugby on Friday, July 1st.

Wages in the Engineering Industry.

A further conference between employers and trade union representatives of the engineering industry was held on Tuesday last. The employers expressed their inability to offer more than 2s. a week increase for plain time workers, and the employés' representatives thereupon intimated that the offer would be submitted to a ballot of the unions' members.

New Australian Company.

A company with the title Scott & Co. (Australasia) Pty., Ltd., has recently been registered in Melbourne, with a capital of £25,000, to carry on the business of ironfounders, mechanical, electrical and tramway engineers, &c.

For Sale.

Bath Corporation Electricity Department invites offers for two Babcock & Wilcox (12,000 lb.) marine-type boilers, with underfeed stokers, forced-draught fan, steel chimneys and dust catchers, and 10,000 110-V lamps of various makes and candle power. Messrs. W. Beardmore & Co., Ltd., invite offers for one marine-type cylindrical boiler, two 625-kW Brush-Ljungström turbo-alternators, two 650-V induction motors, and one helical reduction gear. West Central Merchandise Mart will sell by auction on June 23rd, at 10, Red Lion Passage, Holborn, W.C., a quantity of coils of new and perfect cables and 2,000 coils of twin and workshop flex. Preston Corporation Electricity Department has for disposal one 500-kW rotary-convertor, with booster, exciter, and starting motor, &c., and one 1,250-kVA, 3-phase delta star transformer group. Ilford Corporation Electricity Department invite offers for dismantling and removal of battery and booster plant at the Goodmayes sub-station. (See our advertisement pages to-day.)

Local Exhibition.

MORECAMBE.—A demonstration of electric cooking, organised by the Electricity Department, was given recently. It was stated that during the last twelve months the department had supplied 140 cookers, 20 washing machines, 50 washing boilers, 15 geysers, nine water heaters, and 400 vacuum cleaners, in addition to other miscellaneous electrical appliances.

Russia and British Orders.

It is announced from Baku that Mr. Barinoff, one of the directors of the Azneft (Baku Oil Trust), is reported to have stated that the Trust this year proposed to place with English firms orders of the value of 10,500,000 roubles for electric pumps, compressors, turbo-generators, &c. Now the Trust was only leaving in England orders, the withdrawal of which was undesirable, and which had almost been completed. All the remaining orders would be distributed among other countries. Orders for 2,500,000 roubles which had been destined for England had already been withdrawn and had for the most part been allocated to firms in Germany, America, and Czecho-Slovakia. A further message from Leningrad states that the Electric Current Undertaking (Elektrotok) of that city has discontinued the giving of orders to England, where the Elektrotok has on order two turbo-generators, with accessory mechanical equipment of the value of 2,000,000 roubles. The first set is to be delivered in May, 1928, and the second in July of that year, for installation at the Krasny Oktyaber station now under construction. At the end of May the undertaking is stated to have received confirmation from the Vickers Company that all its obligations would be fulfilled. It is added that the final solution of this question has been handed over for the consideration of the National Committee of Trade, and that further orders required by the undertaking will be placed in Germany and America.

Trade Announcements.

DARIMONT ELECTRIC BATTERIES, LTD., has granted the sole manufacturing and selling rights relating to "Darimont" appliances and accessories to the GENERAL RADIO CO., LTD.

AUTOMATIC & ELECTRIC FURNACES, LTD., has entered into an arrangement with Messrs. G. Blundell & Co., Ltd., of Yokohama, for the sale of the Wild-Barfield electric furnaces in Japan.

MESSRS. LINDSAY & Co. have removed to 9, Cheapside, Liverpool. Telephone: Bank 52.

The THELLEBORG EBONITE WORKS, LTD., has removed to Union Place, Wells Street, W.1.

The head offices of the COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD., and its associated companies, are now at County House, 46-47, New Broad Street, E.C.2.

Catalogues and Lists.

THE PIGGOTT ELECTRICAL CO., LTD., 24, New Bridge Street, E.C.4.—A series of illustrated and priced pamphlets dealing with "Imperial" domestic appliances.

THE SHIPTON AUTOMATIC TELEPHONE SYSTEM, LTD., 37, Tothill Street, S.W.1.—A pamphlet advertising the company's automatic telephone service.

MESSRS. DOWNES & DAVIES, 1 & 3, Stanley Street, Liverpool.—Folder giving illustrated and priced particulars of the "Palatine Luxray" lighting fittings.

MESSRS. E. P. ALLAM & CO., LTD., 107-109, Gray's Inn Road, W.C.2.—Monthly stock list of motors for sale and hire.

THE TUNGSRAM ELECTRIC LAMP WORKS (GREAT BRITAIN), LTD., 72, Oxford Street, W.1.—An illustrated price list of gas-filled and vacuum lamps of various types.

THE WALTERS MANUFACTURING CO., LTD., Kensal Road, W.10.—List No. 125, containing full details and prices of "Koda" active and inert batteries.

MESSRS. HOPKINSONS, LTD., Britannia Works, Huddersfield.—List No. 1870, describing the company's patent "Stamstel" steam valves. Illustrated.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—June price sheet of electrical materials, accessories, and appliances.

MESSRS. EDWARD HOLME & CO., LTD., Moss Lane, Altrincham.—A well-illustrated catalogue of electrical control gear and contactor equipment for many purposes.

THE BUROVOX CO., 48, Rupert Street, W.1.—Two illustrated pamphlets describing "Burovox" telephones for intercommunication purposes and for installation in automobiles.

MESSRS. H. E. ASHDOWN (BIRMINGHAM), LTD., Perry Barr, Birmingham.—A pamphlet (arranged for overprinting) illustrating and describing the company's shock-proof lampholders.

MESSRS. BELBIN & BOWDEN, LTD., 3, Finsbury Square, E.C.2.—A price list of electrical accessories and appliances of all kinds.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—June stock list of motors and dynamos.

MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne.—Pamphlet No. 667, containing illustrated descriptions of examples of the company's large metal-clad draw-out switchgear.

The COOK ELECTRIC CO., 2,700, Southport Avenue, Chicago.—An illustrated catalogue of telephone protectors, terminals and supplies.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Lists Nos. P.213 and 215, illustrating and describing the "Prescot" and "Junior Prescot" ceiling fans respectively.

Mr. F. TUCKETT, 87, The Grove, Broadway, Hammersmith, W.6.—A priced leaflet (No. 62) depicting examples of shades, standards, and other lighting fittings.

The MULLARD WIRELESS SERVICE CO., LTD., Mullard House, Denmark Street, W.C.2.—Two illustrated and priced leaflets advertising examples of the company's valves and one dealing with fixed condensers and resistances.

The LONDON ELECTRICAL CO., 1, Sherborne Lane, King William Street, E.C.4.—A net trade price list of electrical supplies; a price list of conduits and fittings; and a leaflet advertising fans, also priced.

The UNIVERSAL MANUFACTURING CO., 7, St. George's Circus, S.E.1.—A price list of vacuum and gasfilled lamps and a card bearing examples of colours of the firm's opaque enamels.

Bankruptcy Proceedings.

S. B. MARSHALL (trading as the Pytram Manufacturing Co.), Dunbar Road, New Malden, Surrey, designer, manufacturer, &c.—Last day for receiving proofs for dividend, June 25th. Trustee, Mr. F. W. Davis, 28, Theobald's Road, W.C.1.

C. J. NICHOLS (trading as C. J. Nichols & Co.), 7, Park Street, Bridgend, Glam., electrical engineer.—First and final dividend of 2s. 9d. in the £, payable June 20th, at 26, Corporation Street, Birmingham.

Company Liquidation.

HOLBROOK'S ELECTRIC SERVICE CO., LTD., electrical and wireless dealers, 1, Foster Lane, Cheapside, E.C.—A meeting of creditors was held on June 8th, at the offices of Messrs. Chantrey, Button & Co., 61-62, Lincoln's Inn Fields, W.C. Mr. J. Hamp reported that on May 18th last a resolution for voluntary liquidation was passed, and he was appointed liquidator. The statement of affairs which had been prepared showed ranking liabilities of £799, and net assets of £344, or a deficiency so far as the creditors were concerned of £455. The company was registered in 1924 with a nominal capital of £1,000; it was formed for the purpose of taking over a business which had previously been carried on by Messrs. A. E. Snelling and E. Morris for the sale of wireless and electrical fittings. The assets were paid for by a sum of £650 being handed to the vendors, who also subscribed £350 in cash for shares. Mr. J. R. Holbrook became managing director in May, 1924, but he resigned in April, 1926. During the year to April 30th, 1925, the sales were £3,498, and in the following year they fell to £2,628, and in the last twelve months to £2,244. The present position was probably due to the fact that the turnover had been insufficient to meet the expenses. Messrs. Snelling and Morris had advanced to the company sums totalling £264, in respect of which no interest had been paid. There were some inquiries for the business, and if it could be sold as a going concern, a good price might be obtained. If the business could not be sold as a going concern, Mr. Hamp hoped to be able to realise the assets and complete the winding up at an early date. A resolution was passed confirming the voluntary liquidation of the company, with Mr. Hamp as liquidator.

Private Arrangements.

A. H. DICKINSON, trading as A. H. Dickinson & Sons, electrical and wireless dealers, &c., Tidworth, Salisbury, and Bulford Camp.—A meeting of creditors was held on June 9th, when the chair was occupied by Mr. W. H. Cork, 19, Eastcheap, E.C., who presented a statement of affairs which disclosed liabilities of £9,850, of which £4,600 was due to trade creditors; there were partly secured creditors for £6,500, who held security valued at £1,250, leaving £5,250 to rank as unsecured. There was also a fully-secured creditor for £2,050, who held security valued at £3,000, showing a surplus of £950. The assets were valued at £7,160, leaving a deficiency of £2,690. Mr. Cork stated that a conference of the principal creditors was held recently, when a resolution was passed to the effect that a deed of inspectorship and assignment should be executed to

him as trustee, with a committee of five of the principal creditors. The debtor started business about 26 years ago. He was successful until 1919, when the trade was adversely affected. A resolution was passed agreeing that a deed of inspectorship and assignment should be executed to Mr. Cork as trustee with a view to the payment of the liabilities in full. A committee of inspection was also appointed consisting of the representatives of Messrs. Brown Bros., Ltd., Colthurst & Harding, Ltd., Falk, Stadelmann & Co., Ltd., Osmond & Matthews, Ltd., and Mr. Hawkins, representing creditors. It was also decided that the business should be carried on for a period of six months on condition that Mrs. Dickinson gave an undertaking that any loss would be discharged by her. The following are creditors :—

	£		£
Barnes & Mullins ...	61	Fox & Co., Ltd., F. F....	26
Brown Brothers, Ltd. ...	336	Mullard Wireless Service Co., Ltd.	28
Brock, C. T., & Co. ...	103	Osmond & Matthews, Ltd.	261
Colthurst & Harding ...	262	Walter & Sons, J. ...	214
Dunn & Co., R.	74	Wholesale Fittings Co., Ltd.	90
Electric Heating Co. ...	28		
Eckart, Ltd., W. & R....	34		
Falk, Stadelmann & Co., Ltd.	230		

Dissolution of Partnership.

JOHN LIGHTFOOT, 94, Oxford Road, Manchester, electrical engineers.—Messrs. J. & R. G. Lightfoot have dissolved partnership. Mr. J. Lightfoot will attend to debts and continue the business.

Recent Contracts.

Following on the recent contracts placed by the Liverpool Corporation with the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., for a second 25,000-kW turbo-alternator set for the Lister Drive No. 3 power station, two further important contracts, covering the transformers and switchgear for the extensions in Lister Drive power station and for the reconstruction of three sub-stations, have now been placed with the company. The transformer contract covers the supply of eight 10,000-kVA, 3-phase core-type units for new feeders from Lister Drive. Two of the units are designed for 6,300/33,000-V operation, and are duplicates of the six main transformers already installed. The other six units are for 6,300/22,000 V. The necessary extensions to the existing forced cooling and oil filtering equipments are included in the contract. Each phase of the transformer windings is enclosed within a supporting cage in which it can be removed from the core as a unit. The switchgear contract provides for a 19-cubicle extension to the 6,300-V switchboard in the Lister Drive power station, 49 6,300-V circuit-breakers for Lark Lane, Beaumaris Street, and Garston sub-stations, together with auxiliary switchgear and spares. The main power station switchgear is a two-floor masonry cubicle arrangement embodying metal-clad circuit-breakers of the fixed type, and the extension will be similar to the 36 cubicles already installed. The circuit-breakers each have a rupturing capacity of 750,000 kVA. The sub-station circuit-breakers are to be metal-clad draw-out units, with duplicate bus-bars, each unit having a breaking capacity of 250,000 kVA.

Among the orders recently given to MESSRS. BOLCKOW, VAUGHAN & CO., LTD., are two for tramway materials. The Manchester Corporation has ordered 1,000 tons of rails, and the Brisbane Tramways require 1,525 tons of rails and 90 tons of fishplates. In addition, an order for 10,000 tons of rails and 650 tons of fishplates has been received from the Buenos Aires Great Southern Railway.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., has received from the Eastern Telegraph Co., Ltd., an order which is said to be one of the most important of its kind placed in recent years. It is connected with the Eastern Co.'s institution of the regenerator system of working for long-distance traffic, and comprises the supply and laying of over 200 miles of armoured cable between Port Said and Suez. The work is expected to be completed within six months.

Food and Cookery Exhibition.

The 30th annual Food and Cookery Exhibition is to be held at the Holland Park Hall from November 15th to 24th next. Particulars can be obtained from the Westminster Advertising Service, Ltd., 26, Bedford Street, Strand, W.C.2.

Electrical Goods for India.

The *British Export Gazette* reports that while the business passing in India in textile machinery and industrial plant has been rather less active than usual during the past few months, electrical machinery of all kinds continues in demand. Among lines customarily handled by the mercantile community, sales of lighting accessories and fittings are on the up grade, and British goods are more than holding their own against German and American competition. Electro-medical apparatus, electric fans, and electric bells are other lines in which business is being done, and the electrical goods trade as a whole is more promising than ever before. Especially significant is the fact that many new power stations are being established throughout the country, and it will probably be some time before the requirements of the new consumers of light and power are satisfied with regard to fittings, &c.

Australia and German Contracts.

The Sydney *Sun* reports that Mr. Hume Cook, secretary of the Australian Industries Protection League, commenting upon the award of contracts to German firms for a dredger and locomotive for the Yallourn electricity works, by the Victorian Electricity Commission, said :—"These orders contribute still another shock to Australian sentiment. As far as I am aware, no inquiries were made in Australia as to whether the dredger or locomotive could be made in Australia. It is also probably correct to say that no inquiry was made in Britain. At the very moment when the people of Australia are filled with enthusiasm for the Empire, by reason of the Duke of York's visit, responsible State Ministers, without a single word of explanation, calmly approve of proposals which make public patriotism look as shoddy as their own."

In a statement issued by the Electricity Commission, as quoted by the Melbourne *Age*, it is said that three tenders were received for the supply of three electric locomotives, one British and two German. "The British tender was found to be 85 per cent. above the more acceptable of the other two, that of Messrs. Gollin & Co., agents for Messrs. Siemens-Schuckertwerke, at £11,793 c.i.f. and including spare parts."

Correction.

In the fan advertisement of the Edison Swan Electric Co., Ltd., which appeared in our issues of May 21st and June 4th, owing to a dropped figure in the advertisers' electro the wattage of fan No. H367 was shown as 5 watts instead of 45 watts.

The Norwegian Cable Industry.

The Norwegian Storting has decided to deprive the home cable manufacturing industry of the protection which it has enjoyed for two years past in the form of an import duty of 10 öre per kilogramme (100 kr. per ton) on lead-covered cables. The Skandinavisk Kabel Og Gummivare Fabrik, which appears to be the chief company concerned, has informed the Storting that as a consequence of the abandonment of the duties the company has been compelled to discontinue activity as the possibility of remunerative working no longer exists. The company further states that foreign dumping in the past few years has assumed such dimensions that even if the workmen and staff were to give their services free of charge, it could not exist without the duties. A total of 8,000,000 kr. has been invested in the undertaking, and one half is stated to have been lost, and it was intended to re-finance it on the basis of 4,000,000 kr.; the factory is a modern one and the production costs are now only slightly different from those of foreign works. During the years 1921-1926 the imports of lead-covered cables into Norway amounted to 36,000,000 kr., of which about 30,000,000 kr. applied to the years 1921-1924, before the Norwegian company had commenced working on any scale. It is further stated that the Association of Electricity Works is not opposed to a duty of 5 öre per kg., and that the imposition of the duty has not had the effect of increasing the prices of Norwegian cables.

Registered Electrical Contractors.

On June 10th the Executive Committee of the National Register of Electrical Installation Contractors accepted the following applications for registration :—

Higginbotham, A., & Sons, Idle, Bradford.
England, Robinson & Co., Ltd., Harrogate.
Binks, T., & Son, Washington Station, Co. Durham.
Pearce, T., Aylesbury.
Cantwell & Hedger, Broadstairs.
Fawcitt, J., & Co., Sunderland.
Myles & McCaffery, Blackpool.
Seddon, H., Blackpool.
Walker, E., Manchester.
Ollier, G., Blackpool.
Rose, E., Miles Platting, Manchester.
Hutchison, W. E., Cardiff.
Lewis & Hall, King's Heath, Birmingham.
Parker, C., Handsworth, Birmingham.
King, W. E., Rathmines, Dublin.
Keatinge & Gaule, Waterford.
Allen & Welsby, Walkden, nr. Manchester.
Robinson, W. G. M., Leicester.
Ward, G. L., & Co., Cardiff.
Kendal, J., Lomax & Co., Ltd., Manchester.

At the same meeting 10 applications were declined.

A German Amalgamation.

It is proposed to amalgamate the Continental Company for Electrical Undertakings and the Electricity Company (late Schuckert), both of Nuremberg. The former was originally formed by the latter as a financing company for its electrical undertakings to be established, at the time when the Schuckert Company was a manufacturing concern, that is to say, before its Nuremberg works were transferred to the Siemens-Schuckertwerke in 1903. As the losses caused by the war have greatly diminished the development possibilities of the Continental company, and its objects are now identical with those of its founder company, it is considered desirable for the latter to absorb the former.

Book Notices.

Tait's "Electrical Directory of Australia and New Zealand." Price 7s. 6d. Melbourne: Tait Publishing Co. Pty., Ltd.—The 1927 edition of this directory is the seventh issue, and is considerably larger than its predecessors. The particulars regarding all existing undertakings have been completely revised, and it is believed that every Government undertaking, municipal council, company or private concern distributing electricity or operating electric traction systems has been included. Certain new features have been added, including maps of the supply areas in the cities of Adelaide, Melbourne, and Sydney, and maps of the various Australian States and of the north and south islands of New Zealand, showing the principal electrically-supplied cities and towns and main transmission systems. There is also a complete schedule of the retail electricity supply tariffs of the State Electricity Commission of Victoria.

"Advertising, Printing and Art in Commerce," by J. F. Preston and E. Arch. Pp. xvi+301; figs. 196. London: Chapman & Hall, Ltd. Price 16s. net.

"Modern Steelwork, 1927: A Review of Current Practice in the Application of Structural Steelwork to Buildings and Bridges." Pp. 275, illustrated. London: Nash & Alexander, Ltd. Price 5s.

The McGraw-Hill Publishing Co., Ltd., has issued a revised edition of its list of books on metallurgy.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.		Price June 14th.	Fortnight's inc. or dec.
a Acid, Oxalic	per lb.	5½d.	—
a Ammoniac, Sal	per ton.	£60	—
a Ammonia, Muriate (large crystal)	"	£52	—
a Bisulphide of Carbon	"	...	—
a Borax	"	£25	—
a Copper Sulphate	"	£25 10s.	—
a Potash, Chlorate	per lb.	4d. to 4½d.	—
a " Perchlorate	"	5½d.	—
a Shellac	per cwt.	£13 10s.	—
a Sulphur, Commercial	"	£9 10s.	—
a " Roll	"	£9 10s.	—
a Soda, Chlorate	per lb.	3½d to 3¾d.	—
a " Crystals	per ton.	£5 to £5 5s.	—
a Sodium Bichromate, casks	per lb.	4d.	—
METALS, &c.			
b Aluminium, Ingots	per ton.	£107 to £113	—
b " Wire	per lb.	1/6 to 2/-	—
b " Sheet	"	1/8 to 2/9	—
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£259	£3 inc.
Grade II	" "	£193	£2 inc.
Grade III	" "	9½d.	...
c Brass (rolled metal 3" to 12" basis)	per lb.	11½d. to 11¾d.	...
c " Tubes (solid drawn)	"	9¾d.	...
c " Wire, basis	"	1/0½	...
c Copper Tubes (solid drawn)	"	£86	...
c " Bars (best selected)	per ton.	£86	...
c " Sheet	"	£86	...
c " Rod	"	£86	...
d " (Electrolytic) Bars	"	£60 5s.	...
d " " Sheets	"	£144 10s.	...
d " " Wire Rods	"	£70 5s.	...
d " " H.C. Wire	per lb.	8¼d.	...
f Ebonite Rod	"	2/3 to 2/6	...
f " Sheet	"	2/3 to 2/6	...
a German Silver Wire	"	2/3	...
h Gutta-percha, fine	"	8/-	...
h India-rubber, Para fine	"	1/5½	¾d. dec.
i Iron Pig (Cleveland No. 3.)	per ton.	75/-	...
j " Wire, galv. No. 8, P.O. qual.	"	£21	...
g Lead, English pig	"	£26	5/- inc.
g Mercury	per bot.	£20 15s. to £21 10s	25/- to 35/- dec.
a Mica (in original cases) small	per lb.	8d. to 3/-	...
a " " medium	"	4/- to 8/-	...
a " " large	"	10/ to 20/- & up.	...
n Phosphor Bronze, plain castings	"	1/3½	...
p " " drawn bars & rods	"	1/3	...
p " " rolled strip & sheet	"	1/2½	...
p " " wire	"	1/3½	...
o Platinum	per oz.	£28	...
d Silicium Bronze Wire	per lb.	10½d.	...
r Steel, Magnet, in bars	"	7½d.	...
a Tin, Block (English)	per ton.	£292 to £292 10s.	£3 10s. inc.
s " Wire, Nos. 1 to 18	per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Reporting on the lead market, under date June 11th, Messrs. James Forster & Co. stated:—"The position on the whole does not seem too adverse. The American market wears a better tone, and had last week's improvement here been maintained, the price would undoubtedly have been advanced. Germany is consuming about 75 per cent. more lead than a year ago, and consumption in France is improving. In this country demand is still only moderate, but, on the other hand, arrivals during the last six weeks have not been unduly heavy. The position is such that a moderate amount of extra buying by cable-makers would quickly put a different complexion on the market, particularly if, at the same time, there were signs (of which there are none at present) of any curtailment of production."

Social Event.

The eighth annual athletic sports meeting of the London establishments of the General Electric Co., Ltd., was held on June 11th at the company's sports ground at Wembley. The occasion was favoured by excellent weather, and there was a large attendance of friends to witness the keenly-contested events. The programme was a heavy one, including 38 events, and the number of entries was exceptionally large. The various events were run well to time, however, and the programme was carried through without a hitch. It is not possible to give all the events in detail, but the tug-of-war teams (ladies and gentlemen) deservedly attracted general attention, and the ultimate winners were enthusiastically cheered. The prizes were numerous and valuable, and included six handsome challenge cups. Mr. and Mrs. M. J. Railing were among the distinguished visitors, and Mrs. Railing kindly presented the prizes. There was a number of side-shows, and these were surrounded throughout the afternoon by the visitors. The weather, which threatened during the prize distribution to summarily end the proceedings, fortunately held up, and the day was concluded with dancing on the excellent turf. The music during the afternoon and for the dancing was rendered by the band of the 23rd London Regiment, under the direction of Mr. F. E. Poole. The sports officials are to be congratulated on the arrangements made.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during April last amounted to a value of £23,481, as compared with £30,312 in the April, 1926. The aggregate imports during the first four months of the current year are returned at £131,803, as compared with £159,499 in the corresponding period of last year.

Lighting and Power Notes.

Aldershot.—LOAN.—The Town Council has applied for sanction to a loan of £19,800 for mains, services, meters, and a new feeder.

Barnstaple.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £1,800 for providing and laying a feeder cable in High Street.

Burton-on-Trent.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to loans of £25,500 for mains and services, and £6,500 for plant.

Buxton.—HIRE-PURCHASE SCHEME.—The electrical engineer (Mr. A. Bishop) has submitted a scheme to the Borough Council for the hire and hire-purchase of domestic appliances, which has been approved, and the chairman and engineer have been authorised to expend up to £250 in the purchase of apparatus.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—In view of the increased demand for power at Port Arthur and Fort William, Ont., the Ontario Hydro-Electric Power Commission is planning to increase the generating capacity of its Nipigon system from 75,000 h.p. to 230,000 h.p. Work is now in progress for increasing the capacity of the development at Alexandra Landing by 55,000 h.p., and an additional 100,000 h.p. will be generated at Virgin Falls and Portage Island.

Tenders have been invited for building the highest-voltage power transmission line yet to be constructed in Canada. The tenders are for the construction of 200 miles of line from the Ontario side of the Ottawa River at Fitzroy Harbour to Toronto. This transmission line will carry power developed on the Gatineau River in Quebec to Toronto at a pressure of 220,000 V.

It is expected that shortly the Duke-Price Power Company will install the last two generators at its hydro-electric plant on the Saguenay River. The plant, which commenced to deliver power in 1925, now has ten generator units in operation with a capacity of 400,000 h.p. Already these units are fairly well loaded and they will be fully loaded when the Shawinigan Water and Power Company takes the 100,000 h.p. which it has contracted for. The Shawinigan Company is building a h.p. transmission line to Quebec, and it is expected that it will be completed by August. The load being carried by the Duke-Price plant has been steadily increasing during the past year due to industrial activity in the Saguenay district, particularly the operations of Price Brothers' pulp and paper mills, the Aluminium Corporation of Canada, and the Port Alfred Pulp and Paper Mills.

Chesterfield.—LOANS.—The Corporation Electricity Committee is applying for sanction to the borrowing of £1,360 for overhead cables to afford an electricity supply to the area of the Brampton and Walton Urban District Council.

Sanction has been obtained to a loan of £1,777 for a sub-station, transformer kiosks and equipment.

Continental.—LATVIA.—A recently-issued report of the Department of Overseas Trade on the economic and industrial conditions in Latvia (H.M. Stationery Office, 9d. net) states that the electrification schemes which were the subject of so much discussion a few years ago have made no progress, and although they have not been finally abandoned, they will have to remain in abeyance until general conditions become more satisfactory.

ITALY.—The Crown Prince Umberto on June 9th inaugurated the large hydro-electric power station at Mese, which, it is estimated, will have an output of 700,000,000 kWh per annum.—*Reuter* (Sondrio).

Dartford.—ELECTRICITY IN BULK.—Recently the Urban District Council approved a recommendation of the Electricity Committee for carrying out proposed plant extensions in order to meet the increased demand on the undertaking, and authorised application for sanction to a loan of £33,480. The Electricity Commissioners have intimated that any loan granted for plant extensions would have to be paid within a period of 10 years. The Committee has considered the comparative annual costs of local generation and obtaining a bulk supply on terms quoted by the West Kent Electric Co., Ltd., and finds that it would be more economical to purchase electricity in bulk than lay out capital expenditure repayable within such a short period, and has therefore recommended that a bulk supply be obtained from the company.

NEW PLANT.—The Committee has also recommended extensions of the converting plant at an estimated cost of £3,750.

Dover.—SUPPLY TO CORPORATION ENGINEERS.—The Electricity Committee has recommended that the borough electrical engineer be required in future to pay for all electricity consumed by him for cooking and heating purposes, and that a previous resolution sanctioning a supply to the power station superintendent and the mains superintendent at 2½d. per kWh be rescinded.

Gravesend.—CHANGE-OVER.—At a recent meeting of the Corporation Electricity Committee, the town clerk reported that the consent of the Electricity Commissioners had been received to the alteration in the system of supply from 3-wire, d.c., at 460 V and 230 V, to 3-phase, 4-wire, a.c. at a frequency of 50 cycles, and pressures of 400 V and 230 V.

LOAN SANCTIONED.—Sanction has been received to a loan of £12,647 for boiler plant extensions, &c.

Harrogate.—INQUIRY.—An inquiry was held by Col. T. C. Ekin, on behalf of the Electricity Commissioners, at the Royal Spa Rooms on June 8th and 9th, into conflicting applications for Special Orders. The applicants were Mr. R. F. Winder, in respect of an area of a mile and a half from St. James's Church to Boroughbridge; the Electrical Distribution of Yorkshire, Ltd., in respect of Ripon, the rural districts of Ripon, Knaresborough, Great Ouseburn, and part of the rural district of Thirsk; the Harrogate Corporation, in respect of parts of the rural district of Knaresborough; and the Ripon Corporation, in respect of the city of Ripon and the rural district of Ripon less the parish of Sawley. For the company it was stated that it obtained its supply from the Yorkshire Electric Power Co., at a very low rate, and that so far as Ripon was concerned it would be a costly operation to start an organisation, while the Harrogate proposal was unsatisfactory. In support of the Harrogate Corporation's application it was contended that it could supply electricity at as low a rate as any town in England. The Corporation was prepared to change over the system of supply from single- to three-phase a.c., the cost being estimated at £12,000. The Ripon City Council stated that it had provisionally agreed to take a bulk supply from Harrogate. The maximum price scheduled in the Ripon Order was 8d. per kWh, as compared with 10d. in the company's Order. The estimated cost of laying a cable from the northernmost point of the company's system was £18,000. For Mr. Winder, it was stated that plant was already installed at his mill at Boroughbridge, and he was supplying to people in the town. The Commissioners will give their decision in due course.

Hove.—ELECTRICITY EXTENSIONS.—The borough electrical engineer has submitted a report to the Electricity Committee on extensions to meet the increased demand for electricity in the Aldrington area. He recommends the laying of four feeder cables at a total estimated cost, including additional switchboard panels in the sub-station, of £3,830. The Committee has recommended to the Town Council that application be made for sanction to the borrowing of this sum for the purposes stated.

Irish Free State.—DUBLIN.—The City Commissioners have issued a report on recent developments of the electricity undertaking. The report states that during the six years from April 1st, 1920, to March 31st, 1926, a sum of approximately £300,000, which resulted from the working of the electricity department, was re-invested in electricity development work. In addition to this, the gross indebtedness of the undertaking was written down from £559,706 to £429,945. During this period the business done was more than doubled, and the energy sold increased from 10,527,000 to 22,000,000 kWh. The G.N.R. and the Dublin Port and Docks Board closed down their generating stations, and contracted with the Corporation for their full supply of electricity. All the new factories and works which started in Dublin also took their power from the city works. Supplemental supplies were also given to Rathmines and Pembroke electricity works, and a larger turn-over from private power plants to the city supply was secured. The revenue of the Department for the year ended March 31st, 1927, was approximately £320,000, exclusive of meter rents, and the surplus is estimated at £55,000, before making provision for reserve, renewals, or contributions to rates. There were no very abnormal items, with the exception of the large excess expenditure on coal due to the coal dispute, amounting to over £50,000. Some £100,000 has been expended since April 1st, 1926, and it is estimated that a further £200,000 may be expended by the end of the current year. Reductions in the charges for electricity are proposed, amounting in the aggregate to, approximately, 25 per cent.

The Free State Ministry of Industry and Commerce has sanctioned the extension of the Pigeon House power station by the addition of another turbine at a cost of £41,000.

LIMERICK.—The draft agreement in connection with the supplemental supply of electricity by Siemens Bau Union to the Corporation, has now been submitted for consideration. The terms of the draft agreement will come before the Electric Lighting Committee without delay. The cost for making provision for the additional supply is estimated at £25,000, for which a loan will be obtained.

Keighley.—LOAN.—The Corporation Electricity Committee recommends the Council to make application for sanction to borrow £90,000 to cover expenditure during the next two years in connection with the electricity undertaking. The items include mains and services, £50,000; main transmission lines, £7,000; transformers and motor, £6,000; sub-stations and equipment, £12,000; erection and furnishing of new showrooms, £5,000; cookers, radiators, &c., for hire, £6,000; and street lighting, £4,000.

Kendal.—ELECTRICITY SUPPLY.—The Town Council has decided to make its own arrangements for the supply of electricity for the next few years until a national supply becomes available. This decision has been arrived at after consultation with the Electricity Commissioners, and after consideration of the possibility of obtaining a supply of electricity in bulk.

Leyton.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £9,000 for mains and services.

London.—WOOLWICH.—The Town Council has accepted the estimate of the Electricity Committee for the electrical equipment of 360 new houses which are to be "all-electric," the necessary fittings to be installed at a cost of £7,826.

SOUTHWARK.—The *Financial News* reports that the Electricity Commissioners have refused the Borough Council permission to incur an expenditure of £37,500 in developing its electricity undertaking. At the recent inquiry it was contended by the County of London Electricity Supply Co., as ratepayers, and the London Power Co. that a bulk supply would be more economical and a substantial saving to the ratepayers. It was pointed out that the Council's electricity undertaking was a paying concern, but there was a heavy loan, which would be paid off by 1942. The power station was originally built by the Newington Vestry, and supplies power and electricity to only a portion of the borough. Before the formation of the Borough Council, authority was obtained by four companies to supply electricity, and at the inquiry it was contended by them that they were able to meet the increasing needs of the district. The Electricity Committee has decided to ask the Council to consider the position.

BERMONDSEY.—The borough electrical engineer, reporting on the development of the electricity undertaking since its inception 25 years ago, states that the station was opened in January, 1902, the generating plant consisting of three steam-driven dynamos with a total capacity of 375 kW. The generating and converting plant now amounts to 8,500 kW. The feeders have a total length of 14¼ miles, and the length of distribution cables is now 87 miles. There are also five miles of e.h.p. cables. There is a steady demand for electrical energy for industrial purposes, and at present, 60 per cent. of the energy sold is consumed in factories, &c. The Council some few years ago instituted a free wiring scheme, and 3,500 houses have been connected to the mains under this scheme. The capital expenditure on the electricity undertaking now approaches £500,000. Owing to the limitations of space and unsuitability of the site of the electricity works, the later extensions to the plant have been machinery at the sub-stations at Bermondsey and Rotherhithe for transforming and converting electricity purchased in bulk. The Council will shortly have to make provision for further extensions of plant, which will be machinery of this nature.

Northern Ireland.—BALLYCASTLE (Co. ANTRIM).—The Urban District Council has referred to the Electricity Commissioners for Northern Ireland the question of the proposed purchase of the electricity works, the local company having refused an offer of £4,024.

LURGAN (Co. ARMAGH).—The new municipal electricity scheme is nearing completion, and it is expected that an electricity supply will be available before the end of this month. Over 100 consumers have already registered.

BELFAST.—We have received from Mr. Johnstone Wright, city electrical engineer and general manager, a copy of his last report on the working of the Corporation electricity undertaking covering the year ended March 31st last. The total revenue amounted to £379,683, as compared with £355,753 in the preceding year. The cost of production was £183,079, as against £144,467. This increase was wholly accounted for by the

abnormal conditions prevailing, the extra cost arising from the coal dispute being £41,794. The gross profit was therefore £196,604 (£211,256), and after meeting capital charges and sundry items, there was a net surplus of £46,422, as compared with £62,402 in 1925-26. The supply to the shipyards fell considerably, owing to bad trade aggravated by the coal dispute, but this was largely counterbalanced by a record increase in the general lighting and power supply, and the sales of electricity therefore only showed a slight decrease, from 45,086,797 to 44,755,828 kWh. In connection with the extension of the Harbour power station, considerable progress has been made, and the piling and foundation contract will be completed shortly. An 18,750-kW turbo-alternator, complete with condenser and auxiliaries, has been placed on order. This extension is timed to be ready for service during the winter of 1928-29.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

BATLEY.—The increase of 5 per cent., imposed owing to the coal dispute, has been removed.

DEWSBURY.—The increases of 5 per cent. in the charges for lighting and 15 per cent. for power and heating, made owing to the coal strike, have been removed.

EGHAM AND STAINES.—*The Egham and Staines Electricity Co., Ltd.*—Lighting: From 9d. to 7½d. per kWh.

SWANSEA.—The Corporation Electricity Committee has decided to revert to the charges in operation prior to the coal dispute.

Spalding.—ELECTRICITY CHARGES.—The Urban District Council, which will commence a supply of electricity on September 1st next, has decided to reduce the provisional charges from 9d. to 8d. per kWh for lighting, and from 4d. to 3d. per kWh for power, subject to the following discounts:—100 kWh, 2½ per cent.; 200 kWh, 5 per cent.; 300 kWh, 7½ per cent.; 400 kWh, 10 per cent.; 500 kWh, 12½ per cent.; 600 kWh, 15 per cent.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them granted to the Urban District Council of Criccieth for the supply of electricity by the Electricity Distribution of North Wales and District, Ltd., in the urban district, and the Urban District Council of Bridgend to supply in the rural district of Penybont.

Stoke-on-Trent. — LOAN SANCTIONED. — The Corporation Electricity Committee has received sanction to the borrowing of £25,700 for mains and sub-station equipment.

Sunderland.—NEW SUB-STATIONS.—The Corporation has decided to erect two new sub-stations, with mains, one in Adelaide Place at a total estimated cost of £3,615, and the other in Newcastle Road, on a new housing estate, at a total estimated cost of £7,430. A site for another sub-station near the Empire Theatre has been purchased for £450.

INAUGURATION OF NEW PLANT.—In connection with the new plant recently installed by the Corporation electricity works at Hylton Road, it is proposed to invite Sir John Snell to perform the opening ceremony.

Tilbury.—LOANS SANCTIONED.—The Urban District Council has received sanction to a loan of £32,000 for mains and services and £1,960 for plant in connection with the electricity scheme.

Torquay.—LOAN.—The Town Council has applied for sanction to a loan of £20,860 for extensions to the power station at Newton Abbot.

West Penwith.—ELECTRICITY SUPPLY.—The general manager of the West Cornwall Electricity Supply Co., Ltd., Mr. L. A. Hards, appeared before the Rural District Council at Penzance on June 2nd, to obtain the Council's support to the Special Order for which his company has made application. The clerk mentioned that the Council had entered a protest against the use of overhead lines, and against the proposed charge of 1s. per kWh. Mr. Hards said the company was extending its system in a number of directions, and intended to lay approximately 28 miles of h.p. mains this summer, and was practically doubling its station plant at Hayle. With regard to the rate of 1s. per kWh, it was impossible in such scattered rural areas as West Penwith to supply electricity at a lower rate at present. Before the company could erect overhead lines it had to obtain the consent of owners and local authorities and the approval of the Electricity Commissioners. It preferred to lay mains underground, but it was a question of the cost of distribution. The clerk stated that the Special Order was in respect of Sancreed, Sennen, St. Buryan, Gulval, St. Hilary, Marazion, Lelant, Morvah, Towednack, Zennor, &c. The Council gave its consent to the whole of the company's requests.

Wigan.—ELECTRICITY SUPPLY.—The Corporation has approved electricity mains extension to Gidlow, involving the following expenditure:—Sub-station building, £250; e.h.p. mains, £1,027; l.p. main link, £434; l.p. mains on housing estate, £1,024; transformer, £375; switchgear, £550; transformer kiosk, £250; total, £3,910. The whole of the western district is to be changed over to a.c.

The Electricity Department is negotiating with the Orrell and Billinge Councils with a view to giving a supply of electricity in these districts.

Wimbledon.—LOANS.—The Town Council is applying for sanction to the borrowing of £28,000 for new transformer stations and extensions to existing sub-stations as required, £10,000 for the purchase of domestic appliances, and £2,568 to cover expenditure already incurred in the purchase of appliances.

Tramway and Railway Notes.

Continental.—SWITZERLAND.—The first of a new type of electric locomotive for the Swiss Federal Railways has recently been completed at the works of the Brown-Boveri Co., at Munchenstein. It is one of sixteen which are being built by the firm in conjunction with the Winterthur Locomotive and Engineering Works. The engine, which is known as the 2-D-1 type, comprises a four-wheel bogie at the front, eight centrally-located wheels, each pair being independently driven by electric motors of a total capacity of 3,100 h.p., and a single pair of wheels at the rear. On its trials on the line between Berne and Munsingen a maximum speed of over 73 m.p.h. is stated to have been attained.

Some interesting figures have been issued by the directors of the Rathischen railway, whose system is about 173 miles in length, and which has been electrified since 1922. It is stated that the adoption of electric traction has enabled a reduction of 52 per cent. to be made in the engineering staff at the workshops for the maintenance of the electric locomotives, while there has been a reduction of 48 per cent. in the track maintenance department and of 43.5 per cent. in the service personnel. As compared with steam traction it is estimated that 20,000 tons of coal are being saved each year, and that despite a considerable increase in the price of coal, electric traction is still proving more economical than steam.

The recently-completed electrified section of the Swiss Federal railways between Winterthur and Rorshach, a distance of about 44½ miles, is being supplied with electricity from the power station at Amsteg by means of open air transformer stations at Steinen and Gossau, each of which is equipped with three 3,000-kVA, 66,000-15,000-V transformers. For the supply of power to the 32-mile section between Romont, Freiburg and Berne, the power will be supplied from an outdoor transformer station near the railway station at Freiburg, this being also equipped with three 3,000-kVA transformers.

Glasgow.—INCREASED REVENUE.—The revenue of the Corporation tramway undertaking during the past year amounted to £2,340,836, an increase of approximately £82,000. The number of passengers carried decreased by 5,500,000, but since the introduction of a maximum fare of 2d. the revenue has steadily improved.

FARES.—At a recent meeting of the Corporation it was decided to reintroduce the halfpenny fare, which will be brought into operation almost immediately.

Japan.—OSAKA.—The Government has authorised the Municipality of Osaka to construct 35½ miles of underground railway, at a cost of 162,000,000 yen.—*Reuter* (Tokio).

Lincoln.—YEAR'S WORKING.—The loss on the Corporation tramway last year was £1,642, and the Corporation will shortly be called upon to decide whether the system shall be abandoned in favour of omnibuses, which made a net profit of £1,766 during the last 12 months.

Walsall.—PROPOSED TRAMWAY PURCHASE.—The *Electric Railway and Tramway Journal* states that it is understood that the Corporation is negotiating for the acquisition from the South Staffordshire Electric Tramways Co. of the tramways outside the borough connecting Walsall with Wednesbury and Darlaston, and also the tramway between Wednesbury and Darlaston. At present the Corporation has a joint service over the company's lines to and from Wednesbury and Darlaston, but the route between these two towns is operated solely by the company. Some time ago Walsall took over from the company the tramway between Willenhall and Darlaston, and recently Wolverhampton came to terms for the purchase from the same company of the tramway lines between Wolverhampton, Bilston, and Darlaston, Bilston and Willenhall, Bilston and Sedgeley, and Bilston and Bradley, a total length of 12 miles. Further progress with the Wolverhampton scheme is being held up by the failure of the Corporation to secure the necessary consent from the Bilston Council. It is stated, however, that the intention of Wolverhampton is to run railless cars on all these routes when the present deadlock is removed. Should Bilston maintain its present attitude the Wolverhampton Corporation would have no option but to seek Parliamentary powers. It is hoped that as a result of the gradual municipalisation of road transport services of the Black Country it will be possible eventually to arrange for through running between all the important towns.

Telegraph and Telephone Notes.

Australia.—TELEPHONE SERVICE.—There are now 436,000 telephone subscribers in Australia, according to figures made available recently by the Director of Postal Services (Mr. H. P. Brown). According to the *Sydney Morning Herald*, in March, 1927, 5,719 new subscribers were supplied with telephones, a record for any one month in the history of the Commonwealth. The number of persons who applied for telephones but had not yet been connected was 6,310.

Cable Communication between Canada and Australia.—A *Reuter* message from Victoria, B.C., states that the cable ship *Restorer* sailed on June 10th with 70 miles of cable to complete the link of the second Allied cable connecting Canada with the Antipodes. The Canadian Pacific telegraphs will link up the cable with the newly-completed copper line between Vancouver and Halifax, Nova Scotia, approximately 3,400 miles in length, thus completing duplicate cable communication between Australia and England.

Glasgow.—WIRELESS IN LIGHTHOUSES.—It was reported at a meeting of the Clyde Lighthouses Trust that wireless telephonic communication between Cumbrae and Toward was now in working order. The licence of the Postmaster-General was limited to sending and receiving messages on the private business of the Lighthouses Trust, but the clerk was instructed to communicate with the Postmaster-General with a view to having the licence extended to include helping both shipowners and mariners in reporting the arrival of vessels, and also in communicating with steamers during fog, and giving them directions. It was stated that, owing to an invention by Mr. D. Alan Stevenson with synchronised clocks, the installation would be under the estimated cost of £700.

United States.—NEW RADIOGRAM RELAY STATION.—That history repeats itself is once again emphasised by the fact that two decades ago Marconi chose the Newfoundland coast as the best site for the reception of signals originating in England; more recently, transoceanic traffic has been handled from the north shore of Long Island, far to the south. Hence the Belfast, Maine, receiving station of the Radio Corporation of America marks the return of transoceanic radio reception to the north-eastern coast of America. It appears that extensive tests proved that the reception of European signals was much better at Belfast than at Riverhead, on Long Island, where the main receiving station is located. A survey of thunderstorms during the past decade by the United States Weather Bureau indicates that there are twice as many thunderstorms at Riverhead as at Belfast, and so the reception at the former point is more affected; also, while Belfast is nearly north of Riverhead, it lies almost directly on the great circle route from Riverhead to Europe, and is 300 miles nearer the distant transmitters than is Riverhead; for this reason the European radio signals are at least 30 per cent. stronger at Belfast. The new station at present houses 12 complete long-wave receiving sets, operating on wave-lengths from 8,000 to 23,000 metres, in addition to battery and motor-generator equipment, oil heating and steam plant, and has its own water supply. The function of the new station is to pick up radio-telegraph signals from European stations on a uni-directional triple antenna, consisting of three antennas, each nine miles long and spaced six miles apart throughout their parallel spans. It is highly directional, covering only a small angle and capable of receiving signals from Norway to the north and sweeping down to Italy on the south. It is the invention of Mr. H. H. Beverage, and is only 20 feet high itself, strung along on poles very much after the fashion of a rural telephone line. A multiplicity of receiving sets are worked on one Beverage wave antenna, each set being provided with a wave trap and filters so that signals from the desired transmitter are taken off the antenna and then built up by radio-frequency amplification for subsequent detection and audio amplification, and are automatically relayed over leased telegraph lines to the central office in New York City, where they are automatically recorded on high-speed recorders, while the inked paper tape with its wave-line passes by the operator seated before a typewriter on which the dots and dashes are transcribed into complete radiograms.

Radio Notes.

Belgium.—NEW BROADCASTING COMPANY.—The *Financial News* reports that there is a proposal to form a national broadcasting company in Belgium, with a capital of three million francs, to continue for ten years, with the right to extension for a further five years. The present company's equipment and clientele would be taken over, and the State would be interested to the extent of 60 per cent. of the receipts. The board of directors is to consist of 11 members, of whom the Minister of Posts and Telegraphs will appoint the chairman and five other members, and the rest will be appointed by the general meeting. The State will reserve the right to use all the company's equipment for communications of public interest.

Canada.—LICENCES.—Wireless receiving licence revenue in Canada during the 11 months ended February last totalled 207,328 dollars at one dollar each, an increase of 77,462 dollars over the revenue during the corresponding 11 months of the previous fiscal year. Ontario led the provinces in the number of licences issued with 97,851.—*Reuter* (Ottawa).

NEW STATION.—The Winnipeg Grain Exchange will this summer operate a 500-watt broadcasting station, to be erected at a cost of 25,000 dollars; its call letters will be "CJCW."—*Reuter* (Winnipeg).

Colombia.—NEW BROADCASTING STATION.—The Government has concluded a contract with a foreign corporation for the installation of a complete broadcasting station, with a range of 300 km., at Bogotá. The international call letters assigned are HJH-HKZ. The recently completed stations at Carácas (Venezuela) and Balbóa (Panamá) are expected to make the development of radio easier for Colombia. A wireless telegraphic station will also be installed, establishing communication with the remotest provinces.—*Reuter's Trade Service* (Bogotá).

Short-wave Experiments.—RECEPTION TESTS.—During two recent week-ends 24-hour broadcasting tests were carried out by the two short-wave "annexes" to the American station at Schenectady (WGY) uninterruptedly: 2XAF used 32.77 metres and 2XAD 26.8 metres in order to enable distant reception effects to be observed. According to the wireless correspondent of the London *Evening News*, the charts drawn by B.B.C. engineers to illustrate the reception in England of those test transmissions are not encouraging to those who believe in the immediate establishment of world-wide relaying of programmes. Throughout the whole 48 hours of the tests engineers were listening at the B.B.C.'s listening-post at Keston, using special short-wave superheterodyne sets, and from about 10 p.m. till 4 a.m. the signals were at their best, strong and clear enough to be successfully relayed, there being during this period practically no difference between the 32-metre, 26-metre, and 22-metre wave-lengths. At other times, except for short "freak patches," signals were weak, badly distorted and subject to violent fading.

Teaching by Wireless.—That 372 new schools had come on the B.B.C. register this term, and that there were 3,000 schools now in wireless communication with London and Daventry, was the statement made by Mr. J. C. Stobart (B.B.C. Director of Education) on Saturday at a distribution of prizes at the B.B.C. Studio, Savoy Hill, to 19 children successful in examinations dictated by wireless. Captain Ian Fraser, M.P., made the distribution, and said that though, perhaps, the schools would not be superseded in the future, there could be no doubt that teaching by wireless would be of great value to education. The service had gone beyond the experimental stage. Captain Revel, the headmaster of an elementary school, said Captain Fraser had been instrumental in providing more than 3,000 free licences for blind hearers.—*Daily Telegraph*.

The Eclipse of the Sun.—RADIO TESTS.—The British Broadcasting Corporation's stations at London, Daventry, Manchester, Birmingham, and Newcastle-upon-Tyne are to assist observers of the sun during its eclipse on the morning of June 29th. They will transmit a programme of time signals in accordance with the suggestions of the Astronomer-Royal; Mr. F. Hope-Jones is the B.B.C.'s time expert. They will also radiate for the benefit of observers who will attempt to ascertain the effect of the eclipse on radio transmission itself a continuous wave, unmodulated, but swinging continually over a wave-band 10 metres broad, 5 metres on each side of the station's normal wave-length, not merely on June 29th, but in the early mornings of June 27th, 28th, and 30th, and July 1st. This wave will only be interrupted by the time signals. As for short-wave tests during the eclipse, transmissions are being arranged by the Radio Research Board in conjunction with the Radio Society of Great Britain on 90 metres, 45 metres, and 22 metres.

Turkey.—NEW STATION.—At present there is only one station at Osmanié, 16 miles outside Constantinople, which has a wave-length of 1,200 metres; its call is "Radio Stamboul." On June 15th, however, a new station, which has cost over £100,000, was to be opened at Angora, and, says *The Times*, will be the most powerful in the Near East. The control of wireless telegraphy in Turkey is in the hands of a limited company in which the Post Office, the official Anatolian News Agency, and the Banque d'Affaires are interested. Any one can purchase a licence by paying £T14 (30s.), and a heavy fine is imposed on persons who listen without possessing a licence.

Wave-lengths Abandoned.—KILOCYCLE NOTATION.—The British Broadcasting Corporation proposes to adopt forthwith the principle of stating the kilocycle figure instead of the wave-length for all stations. This means that the measurements will be stated in terms of frequency. Support for this step is furnished by the fact by the Union Internationale de Radiophonie, Geneva, has throughout based its system of measurement on frequencies and not on wave-lengths.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Adwick-le-Street.—June 21st. Urban District Council. Cables, boxes, pillars, &c. (June 10th.)

Australia.—MELBOURNE.—August 15th. Postmaster-General's Department. One 55-ton 3-motor-type electrically operated overhead travelling crane. (A.X. 4727.)*

August 16th. Automatic telephone exchange equipment. (B.X. 3566.)

November 14th. State Electricity Commission of Victoria. Two 10,000-kW back-pressure turbo-generators and accessory plant.

SYDNEY.—July 18th. Municipal Council. Boiler-house equipment for the Bunnerong power station. (B.X. 3531.)*

August 15th. Generator neutral earthing resistance. (B.X. 3550.)*

Cheadle and Gatley.—June 28th. Electricity Department. Static transformer, e.h.p. switch cubicle, and transformer switch and distributor kiosk. (June 10th.)

Dundee.—June 24th. Electricity Department. Three 200-kVA outdoor-type transformers and two sets of 750-kW rotary convertors. (June 10th.)

Egypt.—Egyptian State Railways, Telegraphs and Telephones. Chief Inspecting Engineer, Queen Anne's Chambers, Broadway, S.W.1. Telegraph and telephone materials; wire, porcelain insulators, enamelled cable, copper binders and tapes, £E4,000 to £E4,300.

Halifax.—June 25th. T.C. Wiring 118 houses, Albert Road, for electric light; borough engineer. (Returnable deposit of £2 2s.)

Harrogate. — June 27th. Electricity Department. Transformers, meters, house-service fuse boxes. (See this issue.)

Hazel Grove and Bramhall.—June 28th. Urban District Council. 2,800 yd. .06 3-phase, 6,600-V cables, including laying and accessories. (See this issue.)

Inverness.—June 18th. Town Council. Electric lighting work at 30 blocks of houses. Schedules from Mr. J. Hinton Gall, Lombard Street, and Mr. John G. Chisholm, Union Street, Inverness.

Kirkcaldy.—July 2nd. Electricity Department. L.p. a.c. distribution, l.p. and e.h.p. cables, boxes, and roadwork. (June 10th.)

London.—STEPNEY.—July 11th. Electricity Supply Department. Boilers and boiler-house accessories, turbo-alternator, condenser, accessories, and switchgear. (June 3rd.)

METROPOLITAN WATER BOARD. June 23rd. Six and twelve months' supply of electric lamps. Chief Engineer, 173, Rosebery Avenue, E.C.1.

LEWISHAM.—July 4th. Board of Guardians. Steam and electric steriliser plant for the operating theatre. Mr. G. W. Martin, consulting engineer, 33, Arran Road, Catford, S.E.

Manchester.—June 21st. Electricity Committee. Twelve months' supply of time switches. Mr. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.

New Zealand.—WELLINGTON.—August 9th. Public Works Department. 1,500 suspension insulator strings and 470 strain insulator strings. (B.X. 3533.)*

Nottingham. — June 21st. Electricity Department. General stores for 12 months. (June 3rd.)

Smethwick.—June 25th. Smethwick and Oldbury Joint Hospital Committee. Electric lighting installation at the Holly Lane Hospital. Mr. F. Chapman, clerk.

South Africa.—CAPE TOWN.—June 30th. South African Railways and Harbours Board. Gasfilled and vacuum lamps for 12 months. (B.X. 3518.)* Telegraph material. (B.X. 3519.)*

Southend-on-Sea.—July 6th. Light Railways and Electricity Department. L.p. and e.h.p. cables for 12 months. (June 3rd.)

July 5th. 3,000 meter boards. (See this issue.)

Whitehaven.—July 1st. Rural District Council. Laying two miles of overhead cable and erection of fittings, &c., in connection with the electric lighting of streets at Moresby Park Village. Mr. W. J. Goode, engineer and surveyor, Union Hall, Whitehaven.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Bradford.—Electricity Committee. Accepted:—

Erection of steel chimney.—Newton Chambers & Co., Ltd.

Switchgear for Low Estate sub-station and Haworth Road, Toller Lane, Ormond Road, and Great Horton Road transformer chambers.—A. Reyrolle & Co., Ltd.

Buxton.—Borough Council. Accepted:—

Diesel engine and gas engine oil for the electricity works for the ensuing twelve months.—C. C. Wakefield, Ltd.

Chesterfield.—Electricity Committee. Accepted:—

100-kVA transformer (£127).—Hackbridge Electric Construction Co., Ltd.

Tramways Committee. Accepted:—

Two reduction gears, shafting, &c., for the Thronfield depôt (£134).—Crofts (Engineers), Ltd.

Dartford.—Electricity Committee. Recommended:—

Supplying and laying 1,062 yd. of cable from electricity works to West Hill (£1,092).—Johnson & Phillips, Ltd.

Dewsbury.—Town Council. Accepted:—

4,500 yd. cable (£1,207).—Deutsche Kabelwerke A.G.

Douglas (I.o.M.).—Electricity Committee. Accepted:—

One h.p. truck-type switchboard to control one 50-kW and one 500-kW motor-alternators and one h.p. feeder, as well as l.p. panels (£1,439).—Kartret Switchgear Co., Ltd.

Mercury rectifier and equipment for sub-station (£3,415).—Hewittic Electric Co., Ltd.

Motor alternators (£2,345).—Electric Construction Co., Ltd.

Dumfries.—Dumfries and Galloway Joint Sanatorium Board. Accepted:—

Extension and repair of the existing fire alarm and telephone installation at the Sanatorium and Lochmaben Combination Hospital (£295).—A. Baird & Sons.

Glasgow.—Electricity Committee. Recommended:—

Cables, &c., for 1927-28:—

Telephone cables.—Callender's Cable and Construction Co., Ltd.

L.p. cables.—Enfield Cable Works, Ltd.; W. T. Glover and Co., Ltd.; Callender's Cable and Construction Co., Ltd.

H.p. cables.—Callender's Cable and Construction Co., Ltd.; W. T. Glover & Co., Ltd.

Rubber-insulated cables.—Craigpark Cable Co., Ltd.

Flexibles.—Craigpark Cable Co., Ltd.

Meters.—Chamberlain & Hookham, Ltd.; Edison Swan Electric Co., Ltd.; Ferranti, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.

Arc lamp carbons.—General Electric Co., Ltd.

Cast-iron boxes, section pillars, &c.—Carron Company; Falkirk Iron Co., Ltd.; Lion Foundry Co.; McDowall, Steven & Co., Ltd.; Walter Macfarlane and Co., Ltd.; Sykes & Dyson, Ltd.; Robert Taylor and Co., Ltd.

Malleable iron tube and fittings.—Stewarts & Lloyds, Ltd.

Cleansing Committee. Recommended:—

Construction of the garage for electric vehicles at the new refuse destructor works, Govan (£12,627).—Melville, Dundas & Whitson.

Tramways Committee. Recommended:—

Lead-covered cable.—Standard Telephones and Cables, Ltd.

Welding plant.—British Brown, Boveri, Ltd.

India.—BOMBAY.—Corporation Standing Committee. Accepted:—

Electric lamps.—Allen Electric Co.; Spence & Co., Ltd.; Turner, Hoare & Co., Ltd.

Electric accessories.—Allen Electric Co.; Greaves, Cotton and Co., Ltd.

Liverpool.—Tramways and Electric Power and Lighting Committee. Recommended:—

Special steelwork for tramway junctions (£2,538).—Titan Trackwork Co., Ltd.

Repairs to four Worthington cooling towers at Lister Drive power station (£5,180).—W. Griffiths, Sons and Cromwell, Ltd.

London.—ADMIRALTY. Accepted:—
Rotary switches.—Edison Swan Electric Co., Ltd.

Portrush.—Urban District Council.
Repair and extension of the battery of the electric supply works:—
Premier Accumulator Co. (1921), Ltd., less allowance for old material £505
Tudor Accumulator Co., Ltd., less allowance for old material £490
Forshaw & Bradshaw, less allowance for old material £470
T. May. (Accepted.) **£461**
—*Irish Builder and Engineer.*

Seaham.—Durham County Council. Accepted:—
Installation of electric light at Seaham Hall (£351).—Reid, Ferens & Co.

Southport.—Electricity Committee. Accepted:—
One 150,000-gallon-per-hour water-cooling tower (£2,465).—Peter Brotherhood, Ltd.
One 7,000-kW turbo-alternator and accessories (£22,700).—Brush Electrical Engineering Co., Ltd.

Stevenage.—Urban Council. Accepted:—
Supply of electrical plant and a motor for the sewage disposal works pumping plant (£127).—Electric Light and Power Co., Ltd.

Swansea.—Electricity Committee. Accepted:—
Six Bailey boiler meters, steam and air flow (£708).—Industrial Combustion Engineers, Ltd.
One steam flow meter recorder (£118).—Electroflo Meter Co., Ltd.

Education Committee. Accepted:—
Installation of electric lighting at schools.—R. G. Buckland (Glais School); D. O. Williams & Co. (Graig School); G. L. Ward & Co. (Morriston Boys'); G. L. Ward & Co. (Peniel Green Mixed); Cole & Day (Peniel Green Infants'); P. J. Davies (Pentrechwyth School).

Thanet.—Isle of Thanet Joint Hospital Board. Accepted:—
Maintenance, &c., of bells, telephones, &c., at the hospital for 12 months.—E. Coveney (Ramsgate).

Torquay.—Electricity Committee. Accepted:—
Two switchgear panels (£688).—Metropolitan-Vickers Electrical Co., Ltd.

Forthcoming Events.

Institution of Heating and Ventilating Engineers.—June 20th to 22nd. Bournemouth. Summer meeting.

Electrical Contractors' Association.—June 22nd to 25th. Scarborough. Annual conference.

Institution of Welding Engineers.—Wednesday, June 22nd. Engineers' Club, W. 8 p.m. "The Red-Shortness of Weld Metal," by Mr. A. H. Goodyear.

Physical Society.—Friday, June 24th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Water dimmers.
ENGLAND-RICHARDS fluid-free cell.

Notes.

Fatality.

Whilst removing a portable electric saw bench at Messrs. Reichwald's timber yard at South Harbour, Blyth, two employés and Benjamin Jennings, a hawker, of Bedlington Bank Top, received severe electric shocks. Artificial respiration was applied, and the two employés recovered, but in the case of Jennings, the shock proved fatal.

An inquest was held on Friday last, when William Wells, a sawyer, said that he and another were operating an electrically driven saw-bench in the timber yard; Jennings was present collecting sawdust. About five o'clock witness and his companion commenced to shift the saw-bench. Witness put his hand on to it to knock off some dust from the wheel, and received a shock. Victor Lillie, the yard foreman, said he noticed after the accident that the trailing cable, which was attached to the table by means of a plug, had become wrapped round the wheel of the bench. There was nothing to indicate how the deceased got a shock. Dr. W. I. Gordon gave the cause of Jennings's death as heart failure, the result of an electric shock. There were not, however, any burns on the body; Jennings might have died from heart failure on seeing what had occurred. The opinion expressed by Mr. A. J. McCoggan, from the Home Office, was that the fouling of the cable had subjected the connecting plug on the table to a great strain, which had drawn it from its normal position and brought a small portion of unprotected cable into contact with the ironwork, thereby electrifying the bench. The jury returned a verdict of "Death from heart failure consequent upon electric shock accidentally received."

Electrolytic Disinfecting Fluid.

The report for 1926 of the medical officer of health to the borough of Poplar (Dr. F. W. Alexander) states that 65,317 gallons of electrolytic disinfectant fluid were manufactured during 1926 and broken down to 130,635 gallons for distribution. The total cost for materials and electricity was £345, of which £168 was for electrical energy. Since the installation of the plant, a period of 21 years, 957,181 gallons of fluid have been manufactured at a cost of £1,585 for electricity and of £1,898 for materials.

B.E.S.A. Publications.

Recently-issued British Standard Specifications by the British Engineering Standards Association include Nos. 174 to 184 for overhead line materials for telegraph and telephone purposes. These are revisions of the 1923 editions and are issued in two volumes, the first volume comprising specifications Nos. 174-181, and dealing with non-ferrous materials, the second volume comprising Nos. 182-184, and dealing with galvanised iron and steel wire. The following are the chief features in which these specifications differ from the 1923 editions:—Specifications for cadmium-copper wire, tapes, binders and jointing sleeves have been included in specifications Nos. 175, 178, and 181, the only material recognised in the corresponding old specifications being bronze. A new class of material has been introduced into specifications 182-184, this being designated "high-purity iron." This is given as an alternative to the ordinary low-carbon steel, which, of course, is still retained. As the result of experience in working to the original specifications for galvanised line wire, it was found that the data given in the tables were in certain cases inconsistent as between the diameter and weight per mile of the wire. The tables have been fully revised, and are now perfectly consistent amongst themselves. Certain amendments which have been made to the galvanising tests are described in specifications 182-184. Copies of these specifications may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, S.W.1, price 2s. per volume, or 2s. 2d. post free.

Royal Air Force Display.

Air-Marshal Sir John Salmond, Air Officer Commanding-in-Chief, Air Defences of Great Britain, who is also chairman of the R.A.F. Display Committee, will deliver a broadcast address about the display from Savoy Hill to-morrow (Saturday) evening. Arrangements have also been made with the British Broadcasting Corporation for a broadcast of about an hour of three of the principal events. These are the destruction by aeroplanes of an observation kite balloon, the air battle for London in which 30 aircraft will take part, and the air rescue of the European population besieged in an Eastern town. It is specially urged that early booking should take place. Tickets are now obtainable at the usual agencies, and from the Secretary, R.A.F. Display, Uxbridge.

Legal.

MARCONI'S WIRELESS TELEGRAPH CO., LTD.—On Tuesday last Mr. W. Greene, K.C., applied to the Court for a fortnight's adjournment of the company's petition for the confirmation of its reduction of capital. He said that the petition was opposed by shareholders, and a long affidavit had to be answered. Notice had been given to cross-examine Senatore Marconi and Sir Gilbert Garnsey, who had made affidavits in support of the petition.

Mr. Justice Eve granted the adjournment required.

Appointments Vacant.

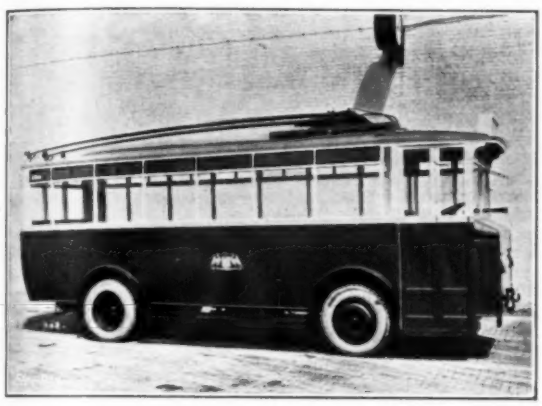
Showroom salesman (£4), stores clerk (£3), for the Radcliffe Urban District Council Electricity Department. Charge engineer for the Peterborough Corporation Electricity Department. Meter mechanic (68s.) for the Bexhill Corporation Electricity Works. Assistant engineer (temporary) and draughtsman (temporary) for the Dublin Corporation Electricity Department. Assistant engineer for the Inverness Corporation Electricity Department. Electrical engineer for the Public Works Department of the Government of Bihar and Orissa. Borough surveyor (£500) for the County Borough of Waterford. (See our advertisement pages to-day.)

Electrical Association for Women.

The Glasgow Branch of the Electrical Association for Women has arranged an outing to the Corporation waterworks at Loch Katrine, where electricity plays a prominent part, on June 20th next.

Holland Adopts Trolley 'Buses.

The first trolley 'bus system in Holland has just been inaugurated by the Municipality of Groningen, which has acquired two Associated Daimler vehicles, to be followed later by a further number if the venture proves satisfactory. The bodies, built by Vickers, Ltd., are of the one-man operated type and provide seating accommodation for 24 passengers; the small seating capacity is explained by the fact that ample room is available for standing. The lowness of the entrance step, which is a feature of these vehicles, has been rendered possible by the low loading height of the "Model 604" chassis frame. Pneumatic tires, size 34 in. by 7 in., are fitted, and a spare is carried underneath the frame behind the rear axle. The "Bull" motor carried in the centre of



Electric Trolley 'Bus for Holland.

the chassis is rated at 55 h.p. at 1,030 r.p.m., and is of the ventilated interpole type. The controller is of the foot-operated E.M.B. type "T" with six plain series accelerating notches, the rheostat being also an E.M.B. unbreakable, jointless, and rustless grid type.

Empire Research.

Estimated to cost £175,000 a year, a scheme for the establishment of a Colonial scientific and research service has been approved of by the Colonial Office Conference. The scheme applies to the non-self-governing Dependencies, including Colonies, Protectorates, and Mandated Territories.

Ultra-Violet Light.

In the course of a lecture on "Ultra-Violet Light" which he recently delivered at a meeting of the Birmingham and Midland Section of the Society of Chemical Industry, Mr. A. A. King summarised the various kinds of radiant energy. Of mercury-vapour lamps there were two types, he said: the vacuum and the atmospheric. In order to obtain a cold ultra-violet radiation it was, until recently, necessary to use a water-cooled vacuum lamp. The lecturer's early experiments had, however, definitely biased him in favour of the atmospheric pattern, and it was the desire to combine the advantages of both types that produced the air-cooled lamp now on the market. He had since been able to improve upon this pattern for chemical and physical research, and the lecturer demonstrated for the first time a new form of air-cooled atmospheric lamp suitable for university laboratory work. By this lamp a much more intense ultra-violet beam could be produced by means of a forced draught of air, the excessive heat being removed without the absorption effect attendant upon heat removal by water. The lamp also lent itself to the application of a sterilised, ozone charged, air stream for therapeutic purposes, and was much more robust to handle than any vacuum mercury-vapour lamp. The model shown comprised the fluorescent cabinet, the open lamp for sun baths, and the medical lamp adapted for applicator work. Continuing, the lecturer said that an important new application of ultra-violet rays lay in the distinction between the fluorescence of pure and impure substances, in which category might be included many true and imitation gems and precious stones. The presence of minute amounts of impurity could be detected and identified by subsequent analysis. Some few months ago he had occasion to ascertain with the aid of the utmost refinement of the then known methods the presence of minute quantities of arsenic in foodstuffs. The Gutzeit method of mercury-arsenic stain was selected for further examination, and an attempt to intensify the stain with monochromatic light served a useful purpose, but when the stains were examined in ultra-violet light the making of a new method was found for the detection and quantitative examination of minute quantities of arsenic quite impossible by previous methods. The absorption of ultra-violet rays by the mercury-arsenic stain gave it an intensely black appearance, and stains which were quite invisible to the naked eye in ordinary light flashed up black upon a phosphorescent background when placed in ultra-violet rays. He had been able to detect with certainty 0.00000005 gramme of arsenious oxide, which meant that this arsenic test was approximately 100 times more sensitive than any other method known. Of the commercial applications of ultra-violet rays there were many in the experimental stage, and a few seemed to have become permanent successes; among the latter were the various cabinets used for testing the fastness of colours, and detecting mildew in wool. The use of such rays for the sterilisation of liquids, particularly water, was a promising line of development.

Electricity in Swiss Industries.

A return lately issued by the Swiss Union of Electricity Consumers shows that the association now comprises 109 firms connected with the textile industry, 51 with the food supply trade, 25 with the chemical industry, 22 with the paper, leather, and timber trades, and 144 with the engineering and metallurgical industries. In addition, there are 120 other miscellaneous members, as well as eight electric railway undertakings. The whole of the members are responsible for an annual consumption of purchased electric power of 650 million kWh, in addition to a private output of 100 million kWh. It is estimated that the consumption of electricity in Switzerland now amounts to 980 kWh per year per head of the population.

The Heaviside Layer.

In a recent lecture before the Royal Institution on "Wireless Transmission and the Upper Atmosphere," Prof. E. V. Appleton is reported by *The Times* to have explained that recent intensive study of the shorter waves had shown that the effects of the Heaviside layer could be detected only a few miles away from the transmitter. As the effects increased with increased distance, they became of importance to broadcast listeners, whose receivers were 100 to 150 miles from the transmitting station. The signal fading they experienced was due to the arrival of two sets of waves at the receiver, one travelling along the ground and the other from the upper atmosphere after reflection at the Heaviside layer, the height of which was about 70 kilometres in the day-time, and after sunset gradually rose often to 120 kilometres, only to fall to its day-time value at sunrise. The layer was found to reflect broadcast waves copiously at night, but in the day-time there was practically no reflection, and only ground waves were received. Listeners situated a long way from the transmitting station who were only able to receive during the dark hours often complained of the uncertain intensity and bad quality of their signals, but they should remember that the day-time signal was the one to which they were really entitled. The night-time signal they received was merely a gift from the upper atmosphere, and they must not complain if the gift was a somewhat variable quantity. With decreasing wave-length the amount of bending the atmosphere would accomplish became less, so that with very short waves penetration of the Heaviside layer became feasible, especially at night, when the amount of electricity in the upper atmosphere was least. It had been said that communication with Mars was impossible because the Heaviside layer would present an impenetrable barrier to wireless waves, but from calculations it appeared as if waves of the order of one metre would penetrate it at night and thus be of no use for long-distance communication. A surprising result had recently been found in the effects of magnetic storms on wireless transmission. Such storms interfered very seriously with long-distance short-wave transmission, and yet with very long waves the signals were stronger than usual. If it was assumed that a magnetic storm increased the electricity in the layer, short waves, which had to penetrate the layer to be bent gradually back to the ground, were more strongly absorbed because they now returned at lower levels, where the friction experienced by the electricity was larger. On the other hand, long waves were truly reflected by the layer at its surface, and an increase in the amount of electricity in the layer increased the amount of this reflection.

Electrical Prospecting for Minerals.

We learn that the electrical process of prospecting for mineral deposits is to be thoroughly tested on a large scale in the Kamiscotia copper area of Northern Ontario. The Hollinger Consolidated holds a large area under option which is heavily overburdened with sand and muskegs, rock outcrops being few in number. Prospecting by the ordinary methods would entail much expense, and an arrangement has been entered into between the company and the Government under which the latter agrees to accept the electrical survey of the claims in lieu of the first year's assessment, on condition that the indications of the survey are to be followed up by diamond drilling. As the company undertakes to make a thorough electrical survey of the whole area covered by its claims this will be a more comprehensive and conclusive test of the value of the process than has hitherto been made in Ontario.

The Effect of High Voltages on Tantalum Anodes.

During some recent work with high voltages upon metal electrodes, Mr. E. N. Dunham has found that tantalum exhibits some very unusual phenomena when used as a positive electrode in certain electrolytes. Very brilliantly coloured films are formed on the metal in the following order: violet, reddish purple, indigo, light blue, green gold, light yellow and finally gray. The colours were produced in succession by increasing the voltage, so that any one of the above colours may be obtained by shutting off the current at the proper time. The films form just before the electrode begins to emit light, and the highly-coloured ones disappear when tiny scintillating sparks appear on the surface of the film. The gray film mentioned above is the final product after the breakdown voltage is exceeded. The films are apparently permanent, and the colours give no evidence of being formed by interference. Mr. Dunham has been unable to reproduce them by heating or other means, and is withholding any possible explanation of the phenomena until further data are available.—*Science.*

Chief Technical Assistants' Association.

On June 9th last the above Association entertained Mr. A. P. MacAlister to a complimentary dinner at the Holborn Restaurant, London, in honour of his being appointed borough electrical engineer of Islington. Mr. A. Murdoch, chairman of the Association, presided. After the loyal toast, the chairman proposed the toast of the guest of the evening, and mentioned that the Association was brought into being mainly by the efforts of Mr. MacAlister. He reviewed the events which led up to its formation in February, 1915, when certain Electricity Supply Bills were before Parliament. The chairman referred to the very high esteem in which the guest was held both in their Association and in the supply industry generally, and heartily congratulated him upon his well-deserved appointment. Other members spoke of their appreciation of Mr. MacAlister's many virtues, and the whole Association joined in wishing him a long, happy, and prosperous career in his new position. On behalf of the members, the chairman presented him with a pair of entrée dishes. Mr. MacAlister, in reply, referred to the various conferences held during the earlier days, and to the work of the late Mr. C. H. Wordingham in the cause of the staff engineer.

Electricity in Agriculture.

In a lecture delivered by Dr. E. A. White, Director of the Committee on Relation of Electricity to Agriculture, at a meeting of the National Electrical Manufacturers' Association at Hot Springs, Virginia, U.S.A., it is stated that the possibility of securing three million new customers—farm customers—is not out of range. According to statistics recently released by the Rural Electric Service Committee of the National Electric Light Association, California, with its great irrigation pumping load, heads the list with 62,000 farms connected, 45.4 per cent. of the total. Then follows New York with 35,600, 18.9 per cent., while Washington, with 20,000 and 27.4 per cent. is next. This report shows 227,422 farms served in 27 States, which would indicate a figure between 300,000 and 350,000 in the United States. According to statistics recently released by the Bureau of Agricultural Economics, U.S. Department of Agriculture, the farm population was 27,892,000 on January 1st, 1927, as compared with 28,541,000 on January 1st, 1926, a decrease of 699,000. Evidently there is something wrong with agriculture. As in other industries, the use of power brings with it at least two distinct possibilities; increased production per worker and improved living standards. Agriculture needs both of these. Agriculture is in a state of transition, with every promise of using more power in the future than it has done in the past.

There is a potential electrical load on the farm of sufficient size to ensure reasonable rates in the more important agricultural regions. The farm-house needs electricity for cooking, refrigeration, lights, water pumping, and numerous conveniences. Studies show a load ranging from 200 to 500 kWh per month per farm. With three farms per mile this would give 9,000 kWh per year per mile of line, solely for household uses. The load on the farm, outside of the household, will vary with the type of farming and future developments in the art of applying electricity to agricultural operations. On the dairy farm it will be large, ranging up to 500 kWh per cow per year. Poultry farming produces a good load. Vegetable gardening is most promising. The general live-stock farmer can use electricity to advantage. In fact, it is only on the grain or cotton farm that the use of electricity has to be confined to the household. Considering the territory most promising for the development of rural electric service during the next five years, it is conservative to say that there are possibilities for the use of up to 18,000 kWh of electricity per mile of line per year. Contrasted with this, 4,000 kWh per mile per year is considered good in non-irrigated regions.

To bring such a development about will require equipment. In New Hampshire the average cost of equipment and installations on seven farms above the average was $2,256.65. In 1926 these seven farms used an average of 4,253 kWh per farm. This was experimental, but it shows the possibilities. In 1926 100,000 rural customers were added to electric service lines. If it cost only an average of $200 to reach each customer and only $50 per home was spent for wiring, this represents $25,000,000 for labour and materials. The present volume of business is bigger than most people realise, for these figures are certainly conservative. There is a market for electrical equipment in rural districts to-day, and it will increase.

Although the progress of the past five years has been great, only 5 per cent. of the farmers of the country are to-day reached by the copper wire. The use of electricity on the farms served, excluding irrigation pumping, is far below the possibilities. Generally speaking, these possibilities are as new to farmers as they are to engineers. The use of electricity on the farm will bring a big readjustment problem to agriculture. It is better that this readjustment should come gradually, with as few mistakes as possible. The farmer needs reliable information as to electrical uses on the farm; so do the manufacturers, and so do the electric light and power companies. The big problem is to take the equipment that we now have and that which will be developed and fit it into farm requirements, or fit farm requirements to it. Instead of educating the farmer, as is so often attempted, and so seldom realised, the farmer should be given a chance to educate himself. Speeches, articles, and pamphlets will have an important place, but the groundwork will be the demonstration.

E.L.M.A. at Teachers' Conference.

At the annual conference of the Association of Teachers in Technical Institutes, held recently at Plymouth, a scientific exhibition was organised and a series of lectures given for the benefit of the general public. Mr. H. Lingard, of the E.L.M.A. Lighting Service Bureau, London, gave a special lecture to the delegates and four lectures to the public on the subject of electric lighting, and displayed some demonstration cabinets. Three cabinets were employed, one of eight sections showing the history of artificial lighting, a four-section one illustrating the effect of the colour of different electric light sources on coloured ribbons, and a special "What-reflectors-will-do" cabinet depicting good and bad shop-window lighting. These cabinets were installed in a small darkened room for the period of the exhibition and created considerable public interest. The keen appreciation shown by the audiences at the lectures indicated the growing interest of the public in the "electric lighting art."

Institution Notes.

Institute of Wireless Technology.

The annual general meeting of the Institute took place on May 25th. The chairman announced the result of the election of officers for the ensuing year, and briefly reported on the progress of the Institute during the past year. This has been very satisfactory; ordinary meetings have been held monthly at the Engineers' Club, at which papers have been read and discussed. A first number of the *Journal* has been published, and an enlarged and improved number is now in the press. The Institute is receiving a good measure of support, and the membership is steadily increasing. The next session of ordinary meetings will open in October, and it is anticipated that sufficient support will be forthcoming to hold informal meetings monthly for discussions on problems of special interest. Those desiring further particulars of the activities of the Institute are invited to address themselves to the hon. secretary at 71, Kingsway, London, W.C.2.

Diesel Engine Users' Association.

At the meeting held on June 10th a paper by Mr. Arthur F. Evans, M.I.A.E., M.I.Mar.E., entitled "Consumers' Oil Tests," was read and discussed. The author said that such tests as did exist and were generally recognised by the oil suppliers fell short of the actual requirements of oil users for the following reasons:—(*a*) They were not universally adopted by oil suppliers; (*b*) they did not give all the required particulars; (*c*) they were too difficult for the ordinary engineering firm to carry out. He recognised that it was almost impossible even in a laboratory to test all the properties of a lubricating oil. For instance, there did not yet exist an apparatus for accurately determining the actual lubricating values of oil under the varied circumstances and conditions of an engine. Neither was there a means of accurately ascertaining the comparative amount of carbon which the oil would deposit in the combustion chamber, the closest approach being the "bomb" test, which at its best was but an approximation. The greater part of the lubricating oil purchased was bought by name and reputation. Where the purchaser was in any case departing from some known brand, the selection was made, apart from commercial considerations, by colour and comparative viscosity at room temperature. After many years' experience in purchasing oils, he commenced testing samples of oil which had been submitted to him. He dealt in detail with the tests which he suggested should be carried out, and gave interesting information regarding the apparatus which was necessary and the method of using it. Copies of the paper, together with an account of the discussion thereon, can be obtained from Mr. Percy Still, joint honorary secretary of the Association.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Following upon the resignation, after nearly 30 years' service, of Mr. F. C. McQUOWN, joint manager and secretary of the County of London Electric Supply Co., Ltd., Mr. H. W. SPRUNT, M.I.E.E., M.I.Mech.E., has been appointed commercial manager, and Mr. JOHN C. DALTON has been appointed secretary of the company.

The *Western Mail* states that Mr. E. MILLWARD, A.M.I.E.E., aged 23, at present employed with Messrs. Bertram Thomas, of Manchester, has been appointed assistant engineer to the Sudan Railways and Steamers. The *Mail* adds that Mr. Millward leaves for the Sudan in a few weeks' time, and he will have sole control of "a new power station to be erected in the lower regions of Southern Egypt, where an electric railroad is being laid."

SENATORE MARCONI was married to the Countess Marie Bezzi-Scali at Rome on Sunday last.

Mr. HAROLD PEACE, of the Dewsbury Corporation electricity works staff, has been presented by his colleagues with an oak clock and a bedroom clock on the occasion of his marriage.

On June 7th, Mr. A. J. B. GOSLING was presented with a set of oxidised copper fire-irons by members of the Electrical Staff of the London, Midland, and Scottish Railway, upon the occasion of his marriage.

The marriage took place on June 6th of Mr. WILLIAM ALEXANDER BLACK, an electrical engineer, at the Tees Station at the Newcastle-upon-Tyne Electric Supply Co., Ltd., and Miss D. MORTON, of Whitby.

Mr. D. MAXWELL BUISH, personal assistant to the Hull Corporation electrical engineer, has been appointed chief electrical engineer to the Synthetic Ammonia and Nitrates, Ltd., of Billingham.

Mr. FRED. W. DAVIES has relinquished the position of manager to Messrs. T. W. Broadbent, Ltd., of Huddersfield, which he has held for more than 20 years, and has established a business under his own name at Electrical Maintenance Works, Colne Road, Huddersfield. He has no manufacturing interests and will carry on a general consulting practice and electrical maintenance and repair business. He has long specialised in the design of a.c. and d.c. generators and motors, and his workshop is equipped for the repair of such machinery.

Obituary.—MR. H. CHILDS.—The death took place on June 8th, at the age of 60 years, of Mr. Henry Childs, electrician at Whipp's Cross Hospital, Walthamstow.

MR. J. C. CRAWSHAW.—Mr. John Charlesworth Crawshaw, who after the war was associated with the English Electric Co., Ltd., at the Bradford works, and latterly was general manager of Crawshaw & Warburton, Ltd., colliery-owners, of Dewsbury, died suddenly while playing tennis on Saturday last. He was 42 years of age.

MR. W. J. NEWBIGIN.—Reports just to hand from Australia state that Mr. William Johnstone Newbigin passed away in April at Sydney, at the age of 53 years. He went to Australia on behalf of Messrs. C. A. Parsons & Co. about 30 years ago. Subsequently he joined the staff of William Adams & Co., Ltd., and during the past four years was managing director. He was a member of the Commonwealth Council for Scientific and Industrial Research, a past-president of the Institute of Engineers of Australia, and a member of the main committee of the Australian Engineering Standards Association.

MR. G. M. TAYLOR.—We regret to record the death, which occurred on June 11th at Kensington, of Mr. G. Midgley Taylor, M.Inst.C.E., at the age of 65 years.

Wills.—The late Sir JOHN TURNEY, of Nottingham, left £172,410 gross and £158,598 net personalty.

Mr. ARCHIBALD CAMPBELL, M.I.E.E., left £3,068 gross and £3,035 net personalty.

The late Captain REGINALD J. WALLIS-JONES left £2,160 gross personalty (net personalty nil).

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Reid Process, Ltd.—Private company. Registered June 7th. Capital, £100 in 1s. shares. Objects:—To carry on the business of a financial, commercial, electrical manufacturing, contracting, promoting, mercantile, developing association, especially electrical matters; to seek for openings for the profitable employment of capital, &c. The subscribers (each with one share) are:—T. H. Higgins, 25, Duke's Avenue, Muswell Hill, printer; R. Elliott, 23, Cranley Gardens, N.10, company secretary. The first directors (to number not less than 2 nor more than 7) are:—Lt.-Col. the Hon. H. Scott Davey, C.M.G., and Major A. H. Woodhouse. Remuneration, £100 per annum (chairman £150). Secretary: R. Elliott. Registered office: 30, St. Swithin's Lane, E.C.4.

Miller's Radio Products, Ltd.—Private company. Registered June 7th. Capital, £100 in 1s. shares. Objects:—To acquire the business formerly carried on by J. W. Miller as wireless components engineer and manufacturer, at 68, Farringdon Street, E.C.4. The subscribers (each with one share) are:—E. C. Goman, 44, Leghorn Road, Harlesden, electrical engineer; A. Secretan, 44, Montgomery Road, Chiswick, W.4, clerk. The first directors are not named. Secretary: F. B. Weller. Registered office: 64, Mill Hill Road, Acton, W.3.

Airships Electric Advertising Co., Ltd.—Private company. Registered June 9th. Capital, £350 in 340 preference shares of £1 each and 2,500 deferred shares of 1d. each. Objects:—To deal in airships, aircraft, balloons and captive airships, and electrical appliances; to act as advertising agents and contractors, &c. The first directors are:—Capt. P. W. Leigh-Pemberton, "Southmead," Newbury; Mrs. J. M. Ford, 21, Collingham Gardens, South Kensington, S.W.5. Qualification, 10 shares. Secretary: John Ford. Registered office: 24, Queen Victoria Street, E.C.4.

Frank Raworth, Ltd.—Private company. Registered June 8th. Capital, £3,000 in £1 shares. Objects:—To acquire the business of electrical engineers and contractors carried on by the executors of Frank Raworth at 36, Spring Gardens, Buxton. The first directors are:—H. Le Mare Jackson, 51, King Street, Manchester, accountant; F. Thompson, 36, Spring Gardens, Buxton, electrical engineer.

Official Returns of Electrical Companies.

Neutron, Ltd.—R. S. Andrews, C.A., of 448, Strand, W.C.2, ceased to act as receiver on May 30th, 1927.

Dulverton Electric Lighting Co., Ltd.—Satisfaction to the extent of £950 on May 31st, 1927, of debentures dated March 12th, 1907, securing £2,000.

Norton Wireless Co., Ltd.—B. A. Nichols, of 54, St. John's Road, Hoxton, N.1, was appointed receiver on May 26th under powers contained in debenture dated March 14th, 1927.

Hazeltine Neutrodyne Radio Sets, Ltd.—Capital, £5,000 in £1 shares. Return dated December 23rd, 1926. 4,900 shares taken up. Nil called up. Mortgages and charges, nil.

Lacy Induction Coil Co., Ltd.—Capital, £26,725 in 25,500 ordinary shares of £1 each and 24,500 founders' shares of 1s. each. Return dated December 29th, 1926 (filed January 20th, 1927). 14,552 ordinary and 12,250 founders' shares taken up. £14,552 paid. £612 10s. considered as paid. Mortgages and charges, nil.

Townlea Electrical Co., Ltd.—Capital, £1,000 in 300 preference and 700 ordinary shares of £1 each. Return dated January 11th, 1927. All shares taken up. £500 considered as paid. Mortgages and charges, nil.

Nox Electric Lamp Co., Ltd.—Return dated January 21st, 1927. Capital at date of return, £2,000 in £1 shares (increased March 16th, 1927, to £15,000 in £1 shares). 502 shares taken up. £2 paid. £500 considered as paid. Mortgages and charges at date of return, £662 13s. 4d. (paid off March 1st, 1927). Since registered: £6,000 debentures (part of a series of £15,000 authorised February 24th, 1927).

Kent Bros. Electric Wire Co. & E. H. Phillips, Ltd.—Capital, £15,000 in £1 shares. Return dated December 31st, 1926. 11,500 shares taken up. £500 paid. £11,000 considered as paid. Mortgages and charges, £15,500.

John Armstrong & Co. (Manchester), Ltd.—Capital, £2,500 in £1 shares. Return dated March 18th, 1927. 1,493 shares taken up. £849 paid. £644 considered as paid. Mortgages and charges, nil.

City Notes.

Sir W. G. Armstrong, Whitworth & Co., Ltd.

The annual meeting was held on June 9th. Lord Southborough, the chairman, was prevented by illness from presiding, and the vice-chairman (Mr. J. F. Taylor) took his place. Mr. Taylor first made reference to the arrangement made in December last for a five years' moratorium (*vide* ELEC. REV., December 17th, 1926, p. 1006), and referred to the losses occasioned by the coal strike. He had been advised that it was necessary to write down the value of the plant and properties by a substantial amount, and the same remarks applied generally to investments. He proceeded to deal with the more important of the last. Adverse circumstances had arisen in the case of the Newfoundland Power and Paper Co., Ltd., and in view of the outlook they had come to the conclusion that further commitments should not be entered into. They had therefore assented to the Newfoundland Company entering into negotiations with the International Paper Co., of New York, which provided for the latter's acquiring the undertaking and assuming responsibility for the further financing of the business. The company had nearly £1,400,000 invested in the Italian company, S. A. Armstrong di Pozzuoli, which had been put into voluntary liquidation. Their investment in the Pearson and Knowles group of companies was also causing them anxiety; to ease the situation a moratorium had been declared in respect of the payment of interest, &c. It was hoped that there would be a recovery in that group. Where other investments had proved a drag upon the company, they were being drastically dealt with, but with an eye all the time to the best possible outcome for the company. Against those adverse circumstances there were important offsets. They had disposed to very good advantage of their investments in the Armstrong Siddeley Companies and in Messrs. Walmsleys, of Bury. The armament business was wholly inadequate. All the civil engineering contracts had been finished, with the exception of those in New Zealand, which could not possibly be completed until 1928 at the earliest. They had claims in respect of several contracts. A small profit had been realised in the construction of the Hermitage Dam in Jamaica, and they had been commended for their work. New lines were not easy to find, and they were examining possibilities which were close to hand. Included in those were closer working arrangements with Vickers, Ltd.; conversations to that end were taking place. When the board was reconstructed a complete scheme of management would be put into operation. In conclusion, Mr. Taylor said that the time was approaching when a revaluation of assets and a considerable writing down of capital would have to be considered.

Electric Construction Co., Ltd.

The annual meeting was held on June 9th, Mr. P. E. Beachcroft (chairman) presiding. In presenting the report (*vide* our last issue, p. 941), the chairman said that the year under review opened with fairly favourable prospects, and their order book showed an improvement. Those prospects, however, were not fulfilled owing to the prolonged coal strike, which caused comparative stagnation in many industries. Such contracts and orders, therefore, as could be procured were subjected to increased costs and severe competition. So intense had competition become in overseas markets that selling prices showed a small surplus only over the cost of labour and materials. They refused to take any order which did not carry a fair share of establishment charges. Although that policy had resulted in a reduced turnover, their position would have been worse if they had not adopted that course. The company was in an exceptionally favourable position to take advantage of any general improvement in trade, of which there was some slight indication. Little or nothing had been done to relax the burden of taxation, which bore so heavily upon industry. On the contrary, they were threatened with more bureaucratic interference in the form of "safety supervisors," who were to undertake duties which were at present admirably discharged by factory inspectors. He hoped that the proposal would be more fully ventilated than it had been before the new officers were appointed. Reviewing the accounts, Mr. Beachcroft said that they felt that, during the present troublous times, at any rate, they could reduce the amount for depreciation. The directors were disappointed that for the first time in the past ten years they were unable to recommend payment of the bonus of 2½ per cent. on the ordinary shares. The present outlook was somewhat obscure, and the indications of a general improvement in trade were still unconvincing, but there was little doubt that when the new Electricity Act was in full operation there would be a greatly increased demand for electrical plant and apparatus.

Kalgoorlie Electric Power and Lighting Corporation, Ltd.

Speaking at the annual meeting on June 9th, the chairman (Mr. G. C. Howard) said that during the year the income debenture stock had been reduced by £10,100 and now stood at £102,800. Although the average receipts per kWh were lower and the expenses had increased, they were able to show better results on account of the fairly steady and full output. They hoped to be able to produce satisfactory figures at the end of the current year. The chairman then referred to the report of the Commission appointed by the Western Australian Government to make recommendations with a view to prolonging the life of the Kalgoorlie mining industry. He said that the Federal Government had since appointed a technical committee to examine the position. That committee recommended an amalgamation of mining interests, co-operation between the management and the workers, and the introduction of capital. They had now to wait to see what the mining companies would do and what measure of financial support would be afforded by the Federal Government. Any practical suggestions would have the full support of the company.

Lisbon Electric Tramways, Ltd.

The net profit for 1926 was £230,826, as compared with £166,624 for 1925. A balance of £9,122 brought forward is added, making £239,948. From this £100,000 is transferred to general reserve, £7,000 to the staff benefit fund, and £10,000 to exchange reserve. A final dividend of 3 per cent. is recommended, making 6 per cent. for the year, and £8,307 is carried forward. £155,756 standing at the credit of the depreciation account has been released and transferred to the general reserve, making £320,756. It is proposed to capitalise £317,013 of this and distribute it in the form of £1 ordinary shares to existing shareholders in the proportion of one new share for each two held. Proposals for giving this effect will be placed before an extraordinary meeting which is to be held after the annual meeting on June 22nd.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

The company, under date June 13th, informed its shareholders, with much regret, that the improving conditions of a year ago, which were interrupted by the coal dispute and the general strike, had not, so far, been re-established. The reduction in the company's turnover during the half-year under review was serious in many directions, although, on the other hand, there were considerable increases in some sections. The announcement reads:—"It is hoped that the second half of the year may, in some measure, compensate for the loss of trade in the earlier months. Your directors fully recognise the imperative need for increased business, and to this end all energies are being directed. In these circumstances they cannot recommend the payment of an interim dividend to the holders of ordinary shares, but the half-yearly dividend on the preference shares will be paid as usual on 1st proximo." The directors add that "there is no truth in the rumours recently circulated as to the possible disposal of this company's business or any portion of it."

Westinghouse Electric and Manufacturing Co.

The sales of this company during 1926 reached the record total of $185,500,000, exceeding those of the previous year by $20,000,000. The net income was $16,138,442, and both preferred and common stock received an 8 per cent. dividend. The current assets are put at $120,000,000, while the current liabilities are only $18,000,000. The value of uncompleted orders at the close of the year was $55,300,000. Mr. Guy E. Tripp (chairman), in his report, says:—"The sales billed for the year reflect the improvement in operations due to the more efficient use of the manufacturing facilities added during the past two years. The cost of sales reflects the keenness of competition and slightly lowered prices. The volume of sales for export increased over the previous year. Competition for export business continued to be keen, but certain affiliations in the foreign field effected during the year should assist in securing a substantial volume of new business."

Cuba Submarine Telegraph Co., Ltd.

The receipts for 1926 were £58,603, as compared with £63,404 in 1925, while the expenses increased from £25,970 to £31,250. After a smaller provision for cable repairs, the balance is £20,481, as against £25,350 (after allowing £3,903 for taxation) in the preceding year. The ordinary shares received an interim dividend of 2½ per cent., free of tax, but after providing for the dividend on the 10 per cent. preference shares, the balance of £18,372 (including £7,891 brought in) is carried forward. The ordinary dividend for the three preceding years was 5 per cent., tax free. The Direct West India Cable Co., Ltd., in March last, offered £10 each for the company's preference shares and £7 for the ordinary shares.

W. T. Henley's Telegraph Works Co., Ltd.

The directors recommend a final dividend on the ordinary shares of 2s. 6d. per share, making 4s. per share for the year. They also recommend a cash bonus of 1s. per share. After placing £50,000 to general reserve as last year, and paying the above dividend and bonus, the amount carried forward to next year will be £506,202, which is an increase of £2,423 on the amount carried forward last year. It is not considered necessary to further increase the carry forward, for which reason the directors are able to recommend the payment of the cash bonus.

Mexican Light and Power Co.

The Canadian Courts have approved the arrangement for dealing with the arrears of dividend on the 7 per cent. cumulative preference shares by the issue of fully-paid 4 per cent. cumulative redeemable second preference shares, and allotment is to be made after the end of this month.

United River Plate Telephone Co., Ltd.

The company reports a total revenue of £2,247,169 for 1926 and a balance on working of £454,955, from which is deducted £13,500, debenture interest, making £441,455. After meeting the preference dividend, it is proposed to pay a final dividend of 5 per cent. on the old ordinary shares, making 8 per cent., free of tax, for the year and a dividend of 5s. per share, free of tax, on the new ordinary shares. This leaves a balance of £28,655, which is added to the amount brought in, making a total of £136,586 to be carried forward. In order to cope with the demand heavy capital commitments have been and will be necessary. It is therefore proposed to increase the capital from £6,000,000 to £7,000,000 by the creation of 200,000 £5 shares; these will not be issued immediately. The report records the death of the deputy-chairman, Sir Frederick Green. His place has been taken by Major E. C. Quilter, and Mr. W. Howard Williams has been appointed to the board. Meeting: June 21st.

A Joint Authority Issue.

The list was to close on or before to-day (Friday) in an issue by the West Midlands Joint Electricity Authority of £2,000,000 5 per cent stock at the price of £98 per cent. The prospectus stated that £500,000 of the proceeds would be used in discharge of a portion of the purchase consideration for the generating stations and other property to be acquired. The plant referred to is at present the property of the Corporations of Shrewsbury, Wolverhampton, Walsall and West Bromwich and the Midland Electric Corporation for Power Distribution, Ltd. The total purchase price is put at £1,329,000.

Whitehall Electric Investments, Ltd.

The gross income for the year ended March 31st last was £712,482, as compared with £708,522 in 1925-26; the net income increased from £456,102 to £468,655. After deducting the preference dividend and one of 2½ per cent. on the ordinary shares, there remains £156,155, which is to be applied in reduction of discount on debenture stock. The meeting was to be held yesterday (Thursday).

Newcastle-upon-Tyne Electric Supply Co., Ltd.

This week the preference and ordinary shareholders were offered 770,000 ordinary shares of £1 each at par in the proportion of one to each five shares at present held. The new shares will participate *pari passu* with the existing shares as from the due dates of the instalments (July 1st and October 1st).

Altrincham Electric Supply, Ltd.

After meeting expenses, including debenture interest, the net profit for 1926 was £27,567 (against £29,181 in 1925). To this is added £927 brought forward, making £28,494. A dividend of 7½ per cent. is recommended on the ordinary shares and £3,500 is allocated to the deferred shares, leaving £1,758 to be carried forward, subject to directors' fees.

Barcelona Traction, Light and Power Co.

An interim dividend of 50 cents per share has been declared on the ordinary stock and one of 1¾ per cent. on the 7 per cent. non-cumulative participating preference stock. The latter stock also receives an additional dividend of 1 per cent., corresponding with that on the ordinary stock.

Richard Johnson, Clapham & Morris, Ltd.

The net profit for 1926-27 was £20,077, and the addition of the balance brought forward gives £28,276. The ordinary dividend is 3¼ per cent. (against *nil* for 1925-26), and a balance of £13,824 is carried forward.

Seaton (Devon) and District Electric Light Co., Ltd.

An increase in revenue of £836 was reported at the recent annual meeting. The balance carried to the net revenue account was £782, as compared with £43 in the previous year.

Globe Telegraph and Trust Co., Ltd.

A final dividend of 5s. per share net is recommended on the ordinary shares, making 10 per cent. net for the year as usual.

Cape Electric Tramways, Ltd.

The directors have declared an interim dividend of 3 per cent., free of tax, as last year.

Chiswick Electricity Supply Corporation, Ltd.

An interim dividend of 7½ per cent. (against 5 per cent.) has been declared.

Mackay Companies.

A quarterly dividend of 1¾ per cent. has been declared on the common stock.

Yorkshire (West Riding) Electric Tramways Co., Ltd.

An interim dividend of 3 per cent. has been declared on the 6 per cent. cumulative preference shares.

Canadian General Electric Co.

A dividend of 1¾ per cent. has been declared in respect of the current quarter.

German Company.

The *Land and Sea Cable Works Company*, Cologne-Nippes, reports that business improved in the second half of 1926 and a further revival has taken place in the current year. After providing for depreciation, the accounts show net profits of 327,000 marks for 1926, as compared with 337,000 marks, the dividend remaining at 10 per cent.

French Companies.

The *Société le Matériel Isolant* reports net profits of 245,000 fr. for 1926; the dividend is 55 fr. per share.

The *Société l'Appareillage Electro-Industriel* earned net profits of 770,000 fr. in 1926, and is paying a dividend of 20 fr. per share.

The *Société le Moteur Electrique* reports a net profit of 107,000 fr.; the dividend is 30 fr. per share.

The 1926 accounts of the *Société la Radiotechnique* show net profits of 1,000,000 fr., and a dividend of 75 fr. per share has been declared.

The *Compagnie Française de Radiophonie* states that its net profit for 1926 was 155,000 fr., which has been carried forward.

The *Société des Accumulateurs Fixés et de Traction* records profits and balance forward amounting to 2,401,000 fr. for 1926; the dividend is 15.625 fr. per share.

The *Compagnie Générale de Télégraphie Sans Fil* reports net profits of 8,507,000 fr. for 1926, as against 7,308,000 fr. in the previous year. It is proposed to increase the dividend from 45 in 1925 to 50 fr. per share.

Swedish Companies.

Aktiebolaget Elektrolux has decided to increase its share capital by a maximum of kr. 25,000,000 nominal, issuing shares giving the right of 1/1,000th part of a vote at meetings. The new capital will be used for the purchase of shares in Aktiebolaget Lux and other companies collaborating with Aktiebolaget Elektrolux.—*Reuter's Trade Service* (Stockholm).

L. M. Ericsson Co.—The net profit for 1926 was 4,410,000 kr., as compared with 4,150,000 kr. for 1925. A dividend of 3 per cent. has been declared.

Swiss Companies.

The report of *Gebruder Sulzer*, Winterthur, for last year shows a net profit of £57,600 as compared with £40,800 in 1925. A dividend of 6 per cent. is again being declared.

The *Alioth Elektrisitäts Gesellschaft*, Basle, reports a net profit of £14,010 for 1926, as against £13,880 in the preceding year, out of which a dividend of 5 per cent. is being paid.

Stocks and Shares.

MONDAY EVENING.

BRAZILIAN Tractions stand out with pre-eminent strength amongst the active securities of the Stock Exchange markets. The appetite of the buyers appears to be insatiable, and the price has gained a further 15 points at 175. The preferred advanced 12 to 146. Reference was made here last week to the favourable comment upon the position of Brazil as reported in an interview with the President of the Brazilian Traction Company, Sir Alexander MacKenzie. There seems to be some odd affinity between the market in these shares and that in American Celanese, the price of which has been rising in meteoric manner, though what connection there can be between Brazilian traction and American artificial silk it is indeed hard to see.

Henley's Telegraph shares are a good deal to the fore by reason of the directors' proposals to pay a 5 per cent. bonus on top of the 20 per cent. dividend. The company is doing very well. In addition to the £300,000 contract obtained from the G.I.P. Railway, Henley's have received a big order from the Eastern Telegraph Company. The price of the shares has risen 3/16ths to 95s., making 6s. 3d. in a fortnight. No other changes of consequence have occurred in this section. Telephone Manufacturing Company shares went back to nearly 5s. 9d. before the price recovered to 6s. 6d. The report is regarded as poor. In 1925 there was a loss of £21,200; for last year the company made a profit of £5,400. After setting aside various allocations, a balance of £1,332 remains, and this it is proposed to carry forward. The meeting is to be held on the Friday in this week. Siemens 4½ per cent. debenture is 2 higher at 91.

The Cuba Submarine Telegraph Company made £20,500 last year, showing a decline of nearly £5,000, as compared with the previous twelve months. No final dividend is to be declared; the company paid an interim of 2½ per cent., tax free, six months ago. It may be recalled that we took Cuba Submarines out of our price list some months ago because, the Direct West India Cable Company having made offers for the Cuba Submarine ordinary and preference (of £7 and £10, respectively), public interest in them became reduced to a minimum. The nominal price is £7, and the last-recorded bargain in the shares was at 6½, early in March. United River Plate Telephones maintain their gain at 9½. In spite of the fact that nothing has yet transpired to account for the remarkable advance in the quotation, the character of the recent buying is considered sufficient justification for the advice that holders should not part with, at any rate, all their interest. A further advance may easily take place. Indo-European Telegraphs have shed £1. The Eastern quartette holds its previously-acquired strength.

Whitehall Electric Investments, a company interested mainly in Mexican and Chilean utility concerns, has done better, making an extra £11,000 profit, at £468,600. The 7½ per cent. preference shares stand at 20s. 6d., and are a reasonable speculative purchase at that price. It is pointed out in the report that the income received from companies operating in Mexico shows a small reduction, but that the progress in Chile has been well maintained. Unsettled conditions in the country are debited with the decline of the company's earnings in Mexico. The Canadian Courts, having approved the scheme of the Mexican Light and Power Company for satisfaction of the accumulated dividends on the 7 per cent. preference shares, letters of allotment are to be issued in respect of the new 4 per cent. "cumulative redeemable second preference shares." The allotment will be made to those who are registered in the company's books on the last day of this month. Mexican Utility descriptions remain almost unchanged, a fall of 1 in the Light and Power common shares being the only noticeable movement.

British Electric Traction ordinary is 2 higher at 151 in response to the publication of an excellent report for the year ended March 31st, 1927. As already announced, the company proposes to pay 8 per cent. on the preference and the ordinary, with the addition of a 10 per cent. bonus, in deferred stock, to holders of the ordinary. This new deferred stock is likely to become a popular investment, and the opening of a market in it will be awaited with no little interest.

Home Railway stocks have few friends, and investors refuse to put much money into an industry so menaced from without by motor competition and, from within, by never-ending talk of labour troubles. We have previously remarked that the underground systems stand in a class different from that of the steam railways, for the Tubes, to quote the description applied to them by a director, are glorified trams, carrying London to work and home again, goods traffic being of nearly negligible proportions. But the Underground group moves to some extent in sympathy with the others, and falls are marked this week in Metropolitans, Districts and Underground £1 shares.

Twenty-one months ago a director of one of these companies wagered a level £50 that Districts, then many points below Metropolitans, would stand higher than the latter in two years' time. The cheque changed hands last week, the winner laughingly observing that he had come home comfortably, with three months in hand.

Barcelona Tractions remain at 51½. The company is paying an interim dividend of 1 per cent. on the common shares, which gives the 7 per cent. preferred an extra 1 per cent. in their quarterly dividend, under the participating rights that the preferred enjoy. Shawinigan Water and Power is several dollars higher, at 93½. Sidros are 15½, and somewhat neglected. Anglo-Argentine Tramways first preference have hardened a trifle. Cape Electric Trams are unchanged at 23s. on declaration of the interim dividend of 3 per cent., tax free. Rangoon Electric 4½ per cent. debenture at 99½ is a couple of points higher. Revived talk of a bonus on Bournemouth and Poole Electricity shares served to raise the price 2s. 3d. to £3, a fair number of transactions taking place up to 61s. An official announcement is expected to be made immediately. Edmundsons are a strong market, with a rise to 28s. 3d. Charing Cross shares rose 6d. to 25s. 6d. County of London new debenture reacted to 1½ premium by reason of the duller tendency in gilt-edged stocks. London Power 5 per cent. debenture is 98 ex dividend, but the scrip, recently-issued, can be bought at 99½, carrying a coupon of 25s. per cent., now payable. As there is no Government stamp on the scrip, the buyer will save money, of course, in taking this, rather than the old registered stock. The two classes are identical in point of security. Electrical Finance preference are again better at 1s. 3d. premium, and the debenture keeps hard at 2 premium. The new Buenos Aires Lacroze debenture at 5s. premium has gone back a few shillings.

Marconis continue to attract lively attention, though greater interest is, perhaps, being paid to Canadians, in which an active market prevails. The price is better on the week at 5s. 6d., and speculation prophesies a higher level than this. Some people hint that the Radio Corporation is accumulating the shares. Marconi 6½ per cent. debenture has risen to 102. In other wireless shares there is no particular animation. The engineering group is dull, but Armstrongs put on a few pence, to 4s., on the chairman's statement at last week's meeting, that "conversations" are proceeding between Armstrongs and Vickers. At 52s. 6d. Babcocks show no alteration.

Disappointment is felt at the India Rubber, Gutta Percha Company's announcement that no interim dividend will be paid on the ordinary shares, although the preference are to receive their half-yearly dividend on July 1st. No interim was paid a year ago on the ordinary, but shareholders had 5 per cent., tax free, last December. The directors contradict the rumour of a possible disposal of the company's business or any part of it. The price of the shares is 22s. 6d. International Telephones have lost a few pence at 39s. 6d. Newcastle Electric Supply at 22s. 6d. are ex the right to apply for the new issue, the offer of 770,000 ordinary shares at £1 each at par. The proportion is one new share for every complete multiple of 5 shares, ordinary and preference alike. This constitutes a useful little bonus. Rubber shares are weak in consequence of another fall in the price of the raw material.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price June 13 1927.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£ 1	14	14	3	+2/3	4 13 7
Brompton Ordinary	1	10	8½	25/-	—	5 13 0
Charing Cross Ordinary	1	15	8½	25/6	+6d.	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	8¾	25/-	—	5 12 0
City of London	1	15	10	1¾	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	30/6	—	5 5 0
County of London	1	15	7½	28/-	—	5 0 0
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	28/3	+1/6	5 13 6
do. 7% Pref.	1	6	7	23/6	—	5 19 1
Elec. Supply Corporation	1	10	10	32/-	—	6 5 0
Kensington Ordinary	1	15	8	25/-	—	5 13 0
Lancs. Light and Power	1	7½	7½	26/-	—	5 15 5
London Electric	1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	5	6	6	5¾	—	5 6 8
Metropolitan	1	11	6	29/-	—	4 16 7
do. 4½% Pref.	1	4½	4½	17/-	—	5 8 6
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	1	7	5	22/6xd	—	4 8 6
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/6	—	5 14 3
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	35/6	—	5 9 10
South London	1	15	8½	25/-	—	5 13 0
South Metropolitan Pref.	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	7	7	25/-	—	5 12 0
do. 6% Pref.	1	6	6	1⅛	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	30/-	—	5 6 8
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	71	—	5 12
Metropolitan	,,	5	3	60	—½	5 0 0
do. District	,,	9½	9½	61	—½	5 14 10
Underground Electric	£1	Nil	1½	18/6	—6d.	1 11 6
do. do. Income	Bonds	6	6	102	—	*5 17 8
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 19 0
do. Def.	,,	1½	1½	24½	—	6 2 5
Automatic Telephone	1	8	10	47/6	—	4 8 6
Chili Telephone	5	5	6	7¾	—	3 17 5
Eastern Extension	10	10	10	18½	—	*5 6 8
Eastern Tel. Ord.	Stock	10	10	182½	—	*5 9 7
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 6 0
do. do. Pref.	10	6	6	11¼	—	5 8 1
Great Northern Tel.	10	20	20	28½	—	7 0 4
Indo-European	25	8½	10	45½	—1	*5 7 6
Marconi	1	Nil	Nil	1¼	—	... ...
Marconi-Marine	1	7½	8½	27/-	—	6 9 8
Oriental Telephone Ord.	1	12	12	56/3	—	*4 5 3
United R. Plate Tel.	5	8	8	9½	—	*4 2 1
Western Telegraph	10	10	10	17½	—	*5 13 8
HOME AND FOREIGN TRAMS, &C.						
Anglo-Arg. Trams First Pref.	5	5½	5½	3 15/16	+1/16	7 15 3
do. do. 2nd Pref.	5	6	6	3½	—	8 2 8
do. do. 5% Deb.	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord.	,,	8	8	151	+2	5 6 0
do. do. 6% Pref.	,,	6	8	120½	—	6 12 10
Brazil Traction	100	5	6	175	+15	3 9 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	90½	+1	5 11 9
do. do. Preferred		6½	6½	122	+1	5 7 8
do. do. Deferred	,,	8	—	158	—	*5 1 3
do. do. Deb.	,,	4½	4½	80½	—	5 5 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	52½	—	7 12 5
Mexico Trams, 5% Bonds	—	5	5	81½	—	6 2 8
Mexican Light Common	100	Nil	Nil	43	—1	Nil
do. Pref.	100	Nil	Nil	110½	—	Nil
do. 1st Bonds	—	5	5	74½	—	6 14 3
Yorkshire (West Riding)	1	5	—	8/9	—	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	1	13	13	52/6	—	4 19 1
British Aluminium Ord.	1	12½	10	43/-	—	4 13 0
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 6
British Insulated Ord.	1	15	15	67/6	—	4 8 11
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3 15/16	—	4 7 3
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	12/6	—	... ...
Edison-Swan	£/-	10	10	10/	—	4 0 0
do. 5% Deb.	Stock	5	5	65	—	5 17 8
Electric Construction	1	10	7½	27/6	—	5 9 1
Enfield Cable Pref.	1	7½	7½	33/6	—	5 17 8
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	3	—	12/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	20	25		4½	+1/16	5 5 3
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	5	5	1¼	—	*4 9 0
Johnson & Phillips	1	17½	12½	25	—	5 0 0
Met.-Vickers Ord.	1	8	8	27/6	—	5 11 4
do. Pref.	2	8	8	28	—	6 14 9
Siemens Ord.	1	7½	7½	27/6	—	5 9 1
Telegraph Construction	12	10	10	28½	—	*4 4 2

* Dividends paid free of Income Tax.

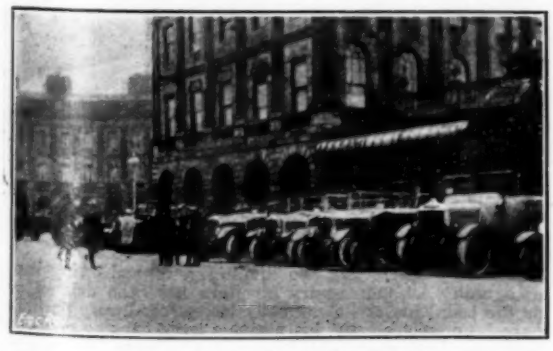
The Incorporated Municipal Electrical Association.—IV.

Annual Convention at Buxton.

ON Thursday, June 2nd, Mr. H. H. Berry's paper on "Electrified Homes of Great Britain" gave rise to a lively discussion; members of the Electrical Association for Women were specially invited to be present, and acquitted themselves with distinction, the remarks of the women who spoke being highly practical and to the point. Afterwards the E.A.W. members and others interested in electrical development lunched together at Ashwood Park Hotel. The afternoon was

Assembling at the Opera House.

devoted to separate meetings of Committee representatives and engineer members; but members of the E.A.W. and other ladies attending the Convention were invited by Dr. and Mrs. Ferranti to visit Baslow Hall, at Baslow, Dr. Ferranti's all-electric house, of which particulars follow; a large party, numbering some 400,



The E.A.W. starting for Baslow Hall.

and including many men, took advantage of this unique privilege, and inspected the installation with keen interest and appreciation. The visitors were entertained to tea, and a hearty vote of thanks was moved by Lady Snell and seconded by Mrs. Ll. B. Atkinson, to which Dr. Ferranti briefly responded. The weather on this and the following day was delightful, fully compensating for the shortcomings of the earlier part of the week.

On Thursday evening the annual dinner of the Association was held in the Pavilion; the President occupied the chair, and there were present some 450 members and ladies.

Friday morning was devoted to the annual meeting. In the afternoon a motor tour to Matlock was thoroughly enjoyed by a large number of the visitors; this was the concluding item of the official programme, but those who stayed at Buxton for the week-end were invited to take part in visits to the electricity works of the Buxton, Macclesfield, and Manchester Corporations, the works

The "Electricar" under Inspection.

of the D.P. Battery Co., Messrs. Hopkinson, Ltd., Ley's Malleable Casting Co., and Mirrlees, Bickerton and Day, Ltd., and the experimental station of the Safety in Mines Research Board at Harpur Hill.

The arrangements for the Convention, which were in the hands of the Hon. Secretary, Mr. A. C. Cramb, the secretary, Miss B. J. Lanfear, and her staff, were carried out on the usual high level of efficiency which

Some well-known members.

has long characterised these meetings of the I.M.E.A., and which has called forth expressions of keen approval on the part of the members; the programme was conducted without a hitch, and the Convention, the largest recorded in the annals of the Association, was also one of the most successful.

The Electrical Equipment of Baslow Hall.

Electric light, electric cooking, and a few electric fires were installed at the Hal. a number of years ago; it was only, however, two years ago that complete electrification was achieved. Since then every requirement of heat, light, and power has been filled electrically, the fundamental feature underlying the installation being the storage of heat in water.

In the discussion on Professor S. Parker Smith's I.E.E. paper on "An All-Electric House," Dr. S. Z. de Ferranti explained the system which he had adopted at the Hall. Remarking that our great handicap in

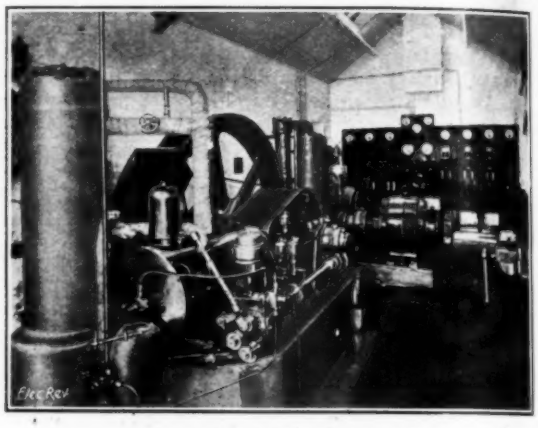
Baslow Hall.

electrical work was that we had no efficient means of storing electricity, he pointed out that hot water was a very cheap form of energy storage, and the provision of a large water tank enabled electricity to be taken at a time when it had practically no value. In his own house he burnt no coal or coke, and used no gas; he burnt crude oil in a 25-h.p. engine, the maximum load being 18 kW (at a time when the battery was assisting the engine). A very large portion of the heat of the jacket water and of the exhaust was used to supply the hot-water storage in the house. He had a

Dining Room.

storage battery containing about 2 tons of lead, and a hot-water storage tank in the basement 6 ft. in diameter, 6½ ft. long, with about 6 in. of heat insulation, holding about 6 tons of hot water. All the principal rooms had invisible panels in the ceilings, consisting of pipes embedded in the plaster below the surface. The general heating was therefore taken care of by radiation at low temperature from the ceilings of all the principal rooms, and not by heating the air by convectors, which were wrongly called radiators. The reason for placing the panels in the ceiling was that they should not heat up the air; the idea was to have in the top of every room a layer of stagnant hot air which kept the surface of the ceiling reasonably warm. The heating was produced by radiation at low temperature from the warm surfaces. The temperature at the surface of the ceiling was 110-120 deg. F. The high-grade radiant heat was produced by electric radiators; every room had one or more of these. The heat efficiency of the whole installation was extremely high; something over 75 per cent. of the heat in the oil was usefully employed.

In the house there are four bathrooms, ten lavatory basins, and five sinks, so that the demand for hot water is considerable. This is obtained from a tank contained inside the large storage tank previously described. Electric lighting is amply provided for. In the cellar there is an electric washer, a motor-driven electric ironer, and a large drying and airing cupboard. There is also an electrically-driven cream



Oil-Engine Generating Plant

separator in the dairy, and an electric fan to keep the air moving in the cellar and the dairy.

The kitchen is provided with a complete cooking range, and an old electric oven made in the early days of electric cooking is still in use and perfectly effective. There are also a number of cooking appliances with self-contained heater elements for which a special table and switch and plug board is provided.

In the main bedrooms the fireplaces have been taken out, and wardrobes have been let into the spaces normally occupied by the grates and chimneys. An air inlet has been arranged which passes underneath the wardrobe to the back of the chimney, so preserving the ventilation obtained before. If the chimney requires cleaning, the wardrobe can be

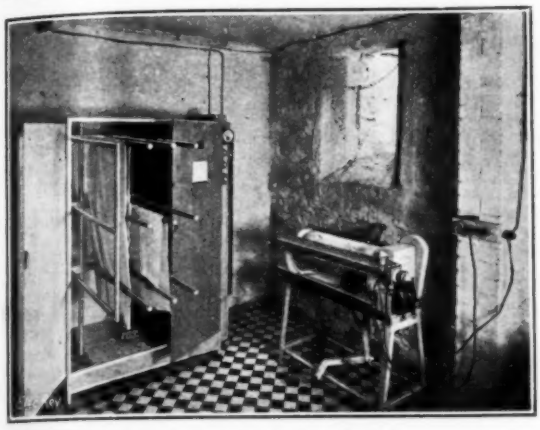
Kitchen.

removed by unscrewing two thumb screws, and lifting it out as a unit. All unnecessary furniture has been deleted, and as the bedrooms are abnormally large, coke-breeze partitions have been erected. By this means a large hanging closet and bathroom have been added to each of the main bedrooms. The closet has been arranged on the American system, in which a light is lit when the door is opened, and is fitted with boot racks, clothes hangers, &c. The bathrooms are fitted with sunk baths and appliances, adjustable mirrors, electric radiators, &c.

In the smaller bedrooms the fireplaces have been taken out and the recesses arranged for an adjustable looking-glass and washing basin. The air outlet is still preserved, but in this instance, as the basin is a fixture and cannot be removed, a special catch trap has been designed by Dr. Ferranti to fit

into a circular aperture above the basin. This traps dirt in the air and allows filtered air to pass into the room. This aperture is also used for cleaning the chimney.

The towel racks in the bathrooms are above the heating apparatus, thereby allowing hot air to circulate through the damp material instead of hanging the towels on hot pipes.



Ironer and Drying Cupboard.

The cow house is fitted with an electric chaff cutter, a food cutter, and other apparatus. The floor of the garage is heated by means of the exhaust gases taken in piping through the floor prior to their being discharged into the atmosphere.

A large electric lawn mower is used for mowing the lawn. Power plugs are connected at different points in the garden, for the electric lawn mower, and at the tennis courts, for teas.

All dirt has been eradicated by the installation of electricity, and the space that was once used for coal and coke and the heating boiler has now been adapted for electric washing.

It has been estimated that by introducing a complete electrical system nearly 50 per cent. has been added to the accommodation of the house, and it is significant to note that where it was necessary, before the installation was complete, to employ five maids to work and keep the house clean, the whole of the work is now being done by two helpers. It will be seen, therefore, that electrical equipment materially lightens the work, reduces the labour costs, and increases the floor space available for useful work.

Electrified Homes.

The Domestic Heating Problem.

By Herbert H. Berry. (*Abstract.*)

The author accepts the "All-Electric Home" as a high standard to be attained and achieved under certain circumstances, and at the same time desires to point out that those circumstances only arise in a percentage of the total number of cases which need diagnosis at the hands of the skilled adviser.

The ultimate solution of the domestic-heating problem lies, not in the adoption of any one particular system as at present, but in a scientific combination of two or even more selected systems which may vary with the local and other conditions. The author desires to draw special attention to a combined system for supplying heat energy for domestic purposes, about which, as far as he knows, little has been said, and no established data published. He will refer to it as the "Colectric System." It represents a combination in modified form of two well-known systems—heat energy generated in the immediate vicinity of the home direct from fuel, plus heat energy generated remotely and distributed in the home in the form of electricity. It is capable of very wide and diverse application, the field including almost every kind of building.

The application in the home is not always the same, but the facts underlying the several principles are more or less identical. In the majority of homes a constant supply of hot water is desirable throughout the day and year, and the principal living rooms, excluding bedrooms, need to be kept warm during the six winter months.

For the purpose of reference, the two systems of heat energy will be separately described as the "constant load" and the "intermittent load." The "constant load" is dealt with from the local furnace, and the "intermittent load" electrically. The "constant load" requires the provision for 52 weeks of constant hot water at 160 deg. F. for domestic purposes, and a means of interior air heating at 55 deg. F. during 26 weeks. The "intermittent load" requires provision for raising the temperature of "constant load" hot water as and when required for cooking and other purposes; the provision of radiant electric heat for topping up the "constant load" temperature in the principal living rooms to 65 deg. F., or for dealing with the spring and fall intermittent load when the "constant load" is shut down; the production of light combined with radiant heat energy, or a reproduction by electricity of the cheerful coal or log fire with radiant heat.

With the "colectric" system the disadvantages inherent in both systems automatically disappear, no artificial humidity is needed and ventilation is simplified. The necessary constant-load convectors are not of sufficient dimensions to make their existence known. The electric radiant glowing fire in a room, whether it is being used at the moment for "topping up" the temperature or not, gets all the credit. The possibility of instantaneously providing a glowing fire and "topping up" with radiant heat where the outside temperature is at or below freezing point and the inside temperature uniform at 55 deg. F. is a luxury so delightful that it is good to know it is within such easy reach. The benefit to health to be derived from sitting in direct radiant heat of short wave-lengths is undeniable. The blood circulation is improved, breathing is deeper and waste matter is expelled more actively by the lungs.

The "Colectric" home is provided with one chimney only. The saving on the simplified construction will completely pay for the installation of the central-heating plant and hot-water system. It is usual in such systems to include convectors in the bedrooms, but since we employ a secondary means of heating, the piping and accessories can be omitted in the upper rooms of the house. The saving thus effected is estimated to more than cover the cost of the electric wiring. The boiler should be of the high-efficiency type in which the central heating water only flows through it. Convectors should be run off from this supply to the living rooms, and hall, or passages, of sufficient heating surface to ensure that the temperature does not fall below 55 deg. F. on the coldest days. Unless required for drinking purposes, it will never be necessary to bring water to the boil from cold. For washing clothes, cooking, and so on, hot water should be used from the tap, and by means of electricity the necessary additional heat for boiling or simmering be applied.

The temperature of the already partly heated living room is "topped up" when required by electric radiation. Here the spectacular effect plays an important part, and it will be very often experienced that no electrical heat is required at all so long as the brilliance of a natural coal fire is maintained. It is this particular feature, controlled from the door, which is so attractive. A combination such as described provides a luxurious method of living under perfect temperature control, and within the means of the humblest purse. The "Colectric" system opens up an entirely new field for the larger class of private installation, as the power required for the intermittent or "topping-up" load can well be supplied by a plant of moderate size. The significance of this application is of vast importance. It means that an electrified home is the most practical proposition regardless of situation.

In certain places where a cheap price for energy is quoted, electrically heated water may be introduced with considerable success. Very great care is needed in the initial lay-out of any such scheme in order that it may function at the maximum efficiency for a given type of load. There can be much said in favour of the local storage tank. The chief defect from the consumer's point of view is the limited hot-water output and the time-lag in heating up afresh. To mitigate as far as possible this trouble, a tank of fairly large capacity must be installed to meet the maximum demands likely to occur during the day.

An alternative all-electric system is the central-storage or pressure-type calorifier thermostatically controlled. The tank in this case can be of a much greater capacity and should be placed as near as possible to the central position relative to the draw-off taps. All such tanks should be well lagged. It is interesting to recall that the radiation per square foot of surface of an unlagged tank working at 150 deg. F. represents an electric consumption of about 30 to 40 watts. In round figures this is equivalent in a 25-gal. tank to a loss of about a quarter of a unit per hour, or approximately 40 units per week. For a polished copper tank the loss is about half. The system has an obvious advantage over local storage, inasmuch as hot water is available to full capacity at any tap to which it may be connected. A dual purpose can be served if the tank is placed in a linen cupboard. It is important to keep the flow pipe runs as short as possible.

Discussion.

Mr. L. L. Robinson, Hackney, opening the discussion, said that for many years he lived in an all-electric flat, and during the past year he had been living in the country in a house which had been so designed that it might become all-electric as soon as the power was available. One thing he had learned was that the all-electric house was much cheaper, where the current was sold at a reasonable rate. He thought Mr. Berry would have to extend his investigations so that they could put the all-electric house within the reach of poor people. He was inclined to advocate a system which allowed the public to heat water and do their cooking by electricity in the summer, and which would enable them to get back to solid fuel in the winter.

Mr. G. Wilkinson, Harrogate, said he had had an all-electric house for 25 years, and had got precisely the system

advocated in the paper, but it could only be justified if one owned his house and not if it were rented. For lighting alone he used less than 3 per cent., for cooking just under 20 per cent., for hot water over 20 per cent., and for room heating 57 per cent.; out of the total of energy consumed no less than 77 per cent. was what he called low-grade heat—something less than boiling point—which could be stored. He suggested that they might introduce a "change circuit" system for getting cheaper electricity, a circuit which was laid out in a very circumscribed area, and took in a spasmodic way the amount of energy which could be supplied between the normal and the top load.

Lady BROOKS, C.B.E., the President of the Birmingham and Midland Branch of the E.A.W., said Mr. Berry's paper was an extraordinarily practical one from the woman's point of view. In the future they were going to receive with open arms everything electrical, but for the moment that was impossible. They wanted closer co-operation with the architects and builders.

Dr. S. Z. DE FERRANTI recognised that it was a most contentious subject. Some people would not give up their open coal fire at any price, but they were out of date or shortly would be. He looked upon the system which Mr. Berry advocated as a makeshift; years ago he had the "Colectric" system, a central system of heating at a low temperature with a water radiator in every room and a furnace in the basement, and "to put it bluntly, we got fed up with it" owing to fumes from the coke furnace. If Mr. Berry said the all-electric house was the ultimate solution he would agree with him, but they must have storage capacity. The output of electricity undertakings would be increased not ten times, but a great deal more when all the requirements of the public were properly met.

Mr. T. HALL, Burton-on-Trent, said that for electricity for heating and cooking they had received £10,000 this year; they were educating people to use electricity for everything they possibly could. He urged the importance of introducing a satisfactory system of storage, and said he was trying out several experiments in the breweries with this object in view. The demands of the breweries for hot water were enormous; one brewery wanted 2,000 or 3,000 kW for this purpose.

Mrs. GREGORY, of West Ham, stressed the point that the people into whose homes they wanted to get electricity were not those who could afford it, but the millions of homes of the workers who would enjoy and appreciate its advantages. They were educating the people of the country with regard to electricity, but she felt that a good many of the men on electricity committees also wanted educating, and it would be useful if more women were members of municipal electricity committees to give the woman's point of view. It was time the engineers found a way of getting the appliances cheaper.

Ald. H. G. ODELL said from the discussion it seemed to him that they were going to throw over the slogan of the "all-electric house" and were going in for a sort of half-way house. But they must have no compromise, they must go for the all-electric house, which was practical, popular, and much appreciated. At Ilford they had received letters expressing satisfaction not only with the electrical service, but also with the cost of it. The main thing was to get the prices right and make the service attractive.

Mrs. A. L. HAYES said if they could get a cheaper supply of electricity and cheaper apparatus they would better help the masses. Mr. Berry's plan was not going to help the masses who were living in present-day houses.

Mr. W. A. GILLOTT said the system proposed by the author would not increase the output of electricity, and drew attention to the value of a coal fire for the destruction of household refuse.

Mrs. H. C. LAMB said they had adopted Mr. Berry's plan and had some of his "Magicoal" fires on approval. Many of their friends had come in and told them what a lot of heat there had been from these fires (when there had been no heat at all). They had been able to keep their friends warm for twenty hours at a cost of a penny. As soon as the women realised what a thick cloud they were putting between the sun and their own children, the domestic fire would disappear. It was the work of the E.A.W. to educate people in this direction. The problem of disposing of refuse must not be lost sight of.

Mr. D. M. PEATTIE, of Manchester, considered that the cost of supplying energy for radiators was too high.

Mrs. H. A. HOWIE, of Walsall, asked what was the use of going on building houses "in the same silly old way." They wanted more women on the Housing Committees, and in the E.A.W.

Mr. F. W. PURSE supported the idea of making a compromise until they could reach a perfect system.

Councillor J. THICKETT, of Walsall, said there was no doubt about the all-electric house being the ideal, but thousands in this country could not even afford gas. Why did they not bring the cost within the limits of the poor?

Mr. E. KILBURN SCOTT gave his experiences in Pittsburgh, where they had central heating by steam, and suggested that electrical undertakings should sell steam as well as electricity. A great many existing power stations were out of date, but the boilers could be used to supply steam.

Mr. BERRY, in reply, said that the all-electric home was the high ideal.

Alderman Mrs. HAMMER, of Hackney, in proposing a vote of thanks to Mr. Berry, said much had been done, and could be done, by wiring and hiring schemes.

The Annual Dinner.

The annual dinner was held at the Buxton Pavilion; Mr. R. W. L. Phillips (president) was in the chair, and there was a large attendance of members and ladies.

After the toast of "The King" had been honoured, Sir HARRY HAWARD, proposing "the I.M.E.A.," congratulated the Association upon its successful work, and extended on behalf of the Electricity Commissioners their best wishes for the future. They recognised the value of such an Association as a means of focusing the ideas and opinions of the 350 local authorities which were operating electricity undertakings, pooling their experiences, providing opportunities for the collective expression of opinion and collective action where such was desirable, and above all things, conducing to a breadth of vision on the part of individual engineers and chairmen of committees which did not come from the mere study of the local undertakings. Such pleasant gatherings as that dinner formed a welcome contract to some of the thorny questions with which the Electricity Commissioners had to deal, and which demanded the wisdom of a Solomon, but unfortunately they were without his power of decision to cut the baby in half. It was impossible to please everybody, but they tried to base their decisions on engineering and technical considerations and not upon party politics or policy. He thought the public generally was not really aware of the extent to which the supply of electricity in this country was dependent upon the efforts of the local authorities. No less than £150,000,000 represented the capital expended by local authorities on their electricity undertakings. During the last year over which statistics were available, he found that only 17 undertakings made calls upon the local rates, totalling about £18,000, whereas 107 undertakings contributed to the rates a sum of £772,000. The Act of Parliament passed last session, like its predecessor the Act of 1919, was a great landmark in the history of the supply industry in Great Britain. He would not hazard a speculation as to what would have been the position in 1926 if the Electricity Commissioners had been able to carry out the intentions and hopes of the sponsors of the measure of 1919; they did their best with the limited powers that Parliament gave them, striking the keynote of co-operation between themselves and the local authorities, and between the local authorities and the companies, but they encountered difficulties and delays of no ordinary kind. By meetings of joint boards of electricity authorities they managed to get them together in some fashion, but there was only one case in which a real union between the parties was effected, and that was in the Midland district. Then came the Central Board, and every undertaking, large and small, would have to look to the Board for its supplies of electricity. With reference to the owners of the selected stations, who would be the pivot of the new system, they felt that all indications pointed to a spirit of co-operation on their part with the Commissioners and the Central Board in working a national scheme. He made an earnest appeal to the owners of the smaller undertakings, as to whose attitude to the new state of affairs he was not quite certain, that they should cordially co-operate with the Commissioners and the Central Board in making this great national effort a success. The sooner all came in the better it would be for them and for everybody else. The great problems that faced the electrical undertakings were those connected with distribution; and here surely there was enough work for the most energetic and enthusiastic engineer. The problem of the domestic load was a pretty tough one for the electrical undertakings; the Electricity Commissioners indulged in a vain hope that they might get advice from the Advisory Committee as to what was an ideal tariff, but unfortunately they drew a blank. Electrical undertakings should be in a position to supply the domestic load when they got it, and he had very grave doubts as to whether many undertakings were adequately equipped in that respect. Vision was needed in all branches of the industry.

Responding to the toast, the PRESIDENT said that King Solomon did not cut the baby in half, but he had heard that recently the Commissioners had cut something in half—that was the period for the repayment of loans. As to his plea that all undertakings should do their best to work under the Act, he could assure Sir Harry that they had been working under very awkward legislation for the last thirty or forty years and were used to it. However difficult this Act was to work, they would do their best with it. The Commissioners themselves would, he feared, experience a considerable amount of difficulty in working the Act and they could be assured of their deepest sympathy in their task. He was utterly sick of the 1926 Act, and had had quite enough of it; they hoped that they should soon see the end of the difficulties that now seemed to be looming ahead.

The Mayor of Bedford, Ald. G. H. BARFORD, J.P., gave "The Buxton Corporation," and thanked the Mayor and Corporation and all the people for what they had done to make the Conference one of the most successful they had ever had.

The Mayor of Buxton (Councillor W. GOODWIN) responded.

Alderman W. WALKER proposed the toast of the "Ladies and Guests" in felicitous terms, and suggested that the ladies might create for them a fashion in the use of electricity.

Lady BROOKS, C.B.E., J.P., in responding, said that what they wanted in the electrical world was vision: electricity and intelligence could not be separated.

During the dinner the Gardens orchestra, under the direction of Mr. Sydney Freedman, rendered selections of music.

The I.M.E.A. Exhibition.

(*Concluded from page* 948.)

On the stand of the GENERAL ELECTRIC CO., LTD., a full range of "Magnet" household appliances included the vacuum cleaner, washing machine, wash boiler, and the refrigerator. Special attention was given to the "Magnet" electric cooker, which showed the latest developments in the company's enclosed hotplates. We understand the G.E.C. has developed a hotplate which is claimed to be fool-proof, quick boiling, very robust, and at the same time has a high efficiency and high insulation resistance, both when hot and cold. Street lighting appliances were also shown, including the "Wembley" lantern in various designs. A special attraction was a large ornamental "Wembley" for promenade and main-street lighting.

MESSRS. KELVINATOR, LTD., displayed three domestic models of the Kelvinator refrigerator, and also a Kelvinator Nizer compressor, which is designed particularly for use with large installations for butchers, hotels, and so on.

A comprehensive range of electrical cooking apparatus was shown on the stand of the HOTPOINT ELECTRIC APPLIANCE CO., LTD. Of special interest was the new Hotpoint cooker, model 6281, fig. 9. It is fitted with a double-door oven, which can be sub-divided into two small ovens, and an efficient grill with a plate-warming chamber. A feature was an electrically heated frypan; it is constructed of cast-iron and fitted with side-handles for lifting. A heat-regulating switch is mounted underneath. The loading is 2,000 watts. An electric wash-boiler, 9-gal. capacity, was also included in this exhibit. The body is constructed of cast-iron, and black glass-enamelled inside. A standard 3-kW, 3-heat immersion heater is provided.

Fig. 9.—Hotpoint Double-door Cooker.

A revised model of the No. 5280 Hotpoint-Falco standard electric cooker was also shown. It has a grey porcelain enamelled hob which carries two "Sadia" boiling plates, 1,800 W each, and a 3-heat grill, 1,500 W. The oven is loaded at 2,000 W. The chief innovation is the fall-down oven door, which is of the usual standard size. The oven lining is fitted with wire runners instead of the usual angle-iron or pressed metal, thus making for greater cleanliness. The grill chamber is fitted with a drop-down door.

The display by Messrs. SADIA, LTD., included "Sadia" automatic thermo-storage water heaters with capacities of from 2 to 44 gal. A full range of fast boiling plates, including the new 4¼-in. circular single-heat plate, was also shown. The latter was also seen mounted as a table stove. A new mercury-break thermostat for a very fine control of air and water temperature was demonstrated, and also automatic time and temperature control switches.

Some improvements to the Bastian storage geyser were seen on the stand of the makers, Messrs. BASTIAN METER CO., LTD. A new model has a white enamel finish, a new method of fitting the terminals, and a capacity of 15 gal. The exhibit also included electric fires embodying the Bastian Quartzalite heating element. The latest Bastian fires are the "Super Imp," 2 kW, the super "Imp de Luxe," 2 kW, the "Black Baby Imp," 1 kW, and the "Sunshine Baby Imp" in brass and copper, 1 kW. These are very attractive models, and so designed that the parts are easily accessible for cleaning.

In accordance with the wishes of the I.M.E.A. Council, Messrs. J. H. TUCKER & CO., LTD., kept their display as simple as possible and confined it to a demonstration of the load-breaking abilities of Tucker tumbler switches of the B.4,000 type. A s.p. 5-A switch that can deal with 33 A at 250 V, and 5 A (its normal rated current) at 525 V d.c., was shown breaking a load of 15 A at 250 V, while a s.p. 15-A switch carried 60 A at 250 V, and 15 A at 550 V d.c. Moulded switch-plates of a new design were shown, eliminating the loose ring, and providing improved insulation, and the "Kwik-wire" terminals, reducing erection costs, were demonstrated.

A variety of apparatus exhibited by Messrs. ARCHIBALD LOW AND SONS, LTD., included a 75-gal. electric thermo-storage tank; this is of copper, white enamelled, and fitted with two 2-kW heaters controlled by the thermostat, and one 2-kW booster heater, fitted near top of tank, controlled by an ordinary switch. This tank is being fitted in an all-electric house in Edinburgh for heating during the off-peak load. A 10-gal. "Highlow" electric hot-water tank, No. 312, which was shown, has a loading of 750 W, and is designed for fitting over a bath. For use over a basin is a 2-gal. "Highlow" tank, No. 345. This was also exhibited; it has a loading of 500 W. The "Highlow" Parker-Smith cooker was also seen on this stand, as also were immersion heaters and electric oil heaters.

Among a variety of ingenious devices seen on the stand of Messrs. VENNER TIME SWITCHES, LTD., was an electrically wound time switch. The winding element consists of a tiny motor of unusual design. A small armature is balanced between two electro-magnets and vibrates with the frequency of the system. By means of an attachment at its centre, it revolves the rotor, the latter embodying a specially designed "free-wheel" clutch. The operation is silent. The makers guarantee the accuracy of the switch to within half an hour per year. It is interchangeable as regards dimensions with the makers' 45-day clock. Another feature of the exhibit was a Venner prepayment attachment, fitted to a Sangamo meter, which is designed to prevent the accuracy of the meter being affected by a varying number of coins being inserted. The "winding stress" is removed from the recording gearing by means of a specially designed fly device. The attachment connects with the ordinary train gear of the meter by the simple engagement of two toothed wheels. By means of a number of price units, each of which completes the train of gearing in the attachment, the reduction can be varied to suit any price per kWh from ½d. to 1s.

Fig. 10.—Venner Silver Grill.

The Venner silver grill, fig. 10, was another item of interest. It consists essentially of two portions, the top or food-containing receptacle, and the bottom, soldered together at the rims. A space between the two portions is partially filled with oil, which is just in contact with the bottom of the pan. The heating elements are contained in the oil, in direct contact with it, so that the heat is transmitted very rapidly to the pan. The cooking surface is of a special black finish, "Russian iron," which, it is claimed, prevents the taste from any one food being transferred to another. The loading is 600 W. A non-return filling valve is fitted for the oil.

The Venner-Shotter water meter was also to be seen. An invention of Mr. G. F. Shotter, of the North Metropolitan Electric Power Supply Co., it is designed to measure the height or flow of water over weirs or notches. The action depends on the electrical conductivity of solutions, and, in use, the liquid to be measured is used as the electrolyte. Two conducting paths are provided by the solution, one in which the dimensions vary with the depth or flow of the solution, and the other in which the dimensions are constant. By measuring the ratio between the currents that flow in the two paths, a function of the depth or flow of the liquid is obtained.

Messrs. Venner also showed photographs of a new system of pneumatic control, for valves on pulverised-fuel plant and steam mains, which they have developed. The control is claimed to be positive in action and to give a visible indication at any desired point when the operation is completed.

Messrs. SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., showed a selection of Siemens-Xcel electric cookers in various sizes. These embody a new totally-enclosed high-efficiency boiling plate which the makers have developed. A few safety kettles, incorporating a cut-out device to prevent damage if the kettle is boiled dry, were also exhibited. A feature of the display was a new type of cast-iron boiling ring, incorporating the standard cooker boiling-plate element. Other exhibits included a new design of bathroom fire, a new type of bowl fire, and immersion heaters in various sizes and loadings.

The "Electra" lawn mower (ELECTRICAL REVIEW, April 15th, 1927, p. 615, in two models, 16- and 20-in. cutting widths, was exhibited by Messrs. RANSOMES, SIMS & JEFFERIES, LTD.

A selection of electric heaters developed since the last I.M.E.A. convention at Glasgow was on view on the stand of MESSRS. YOUNG, OSMOND & YOUNG, LTD. The internal construction of the Unity tubular heater has been greatly improved, and the sample shown at Glasgow has been adopted as the standard. The use of porcelain as a support for the element has been abandoned, and a longitudinal mica strip used instead. There is, therefore, the minimum internal mass of material to be heated, and the tube itself begins to warm up rapidly as soon as current is switched on. Although the tube is not lined by insulating material it is impossible to make contact with the tube even in the event of the element breaking, since the distance between the supports is less than the radius of the tube. As the element is designed to work at a black heat, the current density has to be low and the cross sectional area correspondingly large; the chance of a broken element is therefore very small.

In addition to examples of the usual straight tubular heater, some curved tubes were shown. These are suitable for

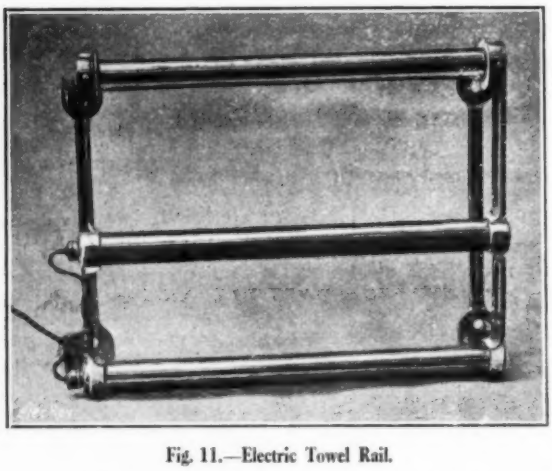


Fig. 11.—Electric Towel Rail.

installation under the curved seats of theatres and kinemas. Electric towel rails, fig. 11, in which the tubular heaters are incorporated, were shown. A feature of interest was a new terminal box for use with double rows of tubes. This ensures correct alignment and simplifies wiring. Other exhibits included tubular radiators and a selection of standard watertight and gas-tight heaters developed for the heating of buildings in which explosive vapours are present.

Among the manufactures of CARRON COMPANY on view were electric cookers, fires, irons, wash boilers, and so on. The cookers included model No. 310 F, a feature of which is its porcelain enamelled door and sides. The total loading of the cooker is 6,750 W. A similar type, but for larger households, No. 311, was also shown. Besides a larger oven, this model has three boiling plates. It can also be supplied with porcelain enamelled sides. The total loading is 8,200 W. In another range which was on view, No. 313, the oven and grill are mounted on legs at a convenient working height; it should appeal to those interested in the table form of cooking appliance. In the selection of the electric fires was the company's latest design, No. 271. This is 14 in. wide by 23 in. high, has a loading of 2 kW and is highly finished.

A range of water-heating apparatus was a feature of the display of Messrs. GEORGE NOBBS, LTD. A variety of "Genii" appliances included: "Vectis" local storage-type water heaters with capacities of from 5 to 30 gal. and loadings from 100 W upwards; "Push-system" water heaters suitable for bulkhead or wall fixing, with capacities of from 1½ to 15 gal. and loadings of 50 W upwards; "Safety" geysers with interlocked switches and water valves, loadings 3 to 40 kW; "National" calorifiers for serving a number of hot-water draw-offs from one central point, suitable for bulk storage by night; and blade-type immersion heaters. A range of water distillers suitable for use in battery-charging stations was also shown. A feature of the stand was a range of central-heating batteries for the hot-air warming of buildings. These have steel housings and loadings varying from 1 to 500 kW.

The "Boby" air-cooled automatic refrigerator shown by Messrs. ROBERT BOBY, LTD., is claimed to be the first of its kind to be manufactured by a British firm. It is intended for domestic use, and is made up in two styles in cabinets constructed of compressed cork slab insulation. The small electric refrigerator machine is contained in the base of the cabinet, and is completely automatic. The cabinet is at present made in four different sizes—10, 15, 20, and 30 cu. ft.

Messrs. BERRY'S ELECTRIC, LTD., introduced for the first time some very beautiful designs of "Magicoal" fires in which was incorporated the new "living flame" effect. The first model of this was recently supplied for the Duke and Duchess of York's new residence. Another new exhibit was a radiant heater of the reflector type with a novel heating element. In the 3-kW size of this there are three separate windings on one central rod, which can be switched on one at a time. Each winding is carried from end to end of the bar, so that the heat is distributed over the whole length of the reflector, no matter how many sections are turned on at a time.

The McClary cooker was also shown. We understand that the works which are being erected for the manufacture of this cooker are nearing completion. The McClary cooker is enamelled inside and out. The oven is fitted with removable elements, racks, and so on, making the whole of the interior perfectly plain for easy cleaning.

The "Savage" electric washing machine was another Berry exhibit. This wringerless machine will, it is claimed, do the four operations of clothes washing—washing, blueing, rinsing, and drying—without removing the "wash" from the tub in which it was originally placed.

A feature of particular interest on the stand of the BRITISH THOMSON-HOUSTON CO., LTD., was a new type of motor which embodied many valuable improvements in design. Two of these machines, one a.c. and one d.c., were of the same rated output and had identical essential dimensions, a feature of great importance to builders of machines intended for different supply systems. The motors will run at any angle and can be supplied with simple enclosing covers to give any desired form of protection. An interesting point in connection with the rotor of the squirrel-cage type of motor is that there are no joints in the cage. The aluminium bars and end-rings are cast in one piece by a patented centrifugal process which ensures uniformity of texture and eliminates the tendency to fracture.

A range of "Inventum" apparatus attracted a good deal of attention on the stand of MESSRS. DRAKE & GORHAM, LTD. One exhibited article, the "Domestic" cistern, is particularly recommended for use where small quantities of water are required at frequent intervals. A gallon and a half of water at 195 deg. F. is available about 1½ hours after switching on. It has a loading of 500 W, and is complete with a 3-pin plug and safety socket. It is thermostat controlled. An unusual

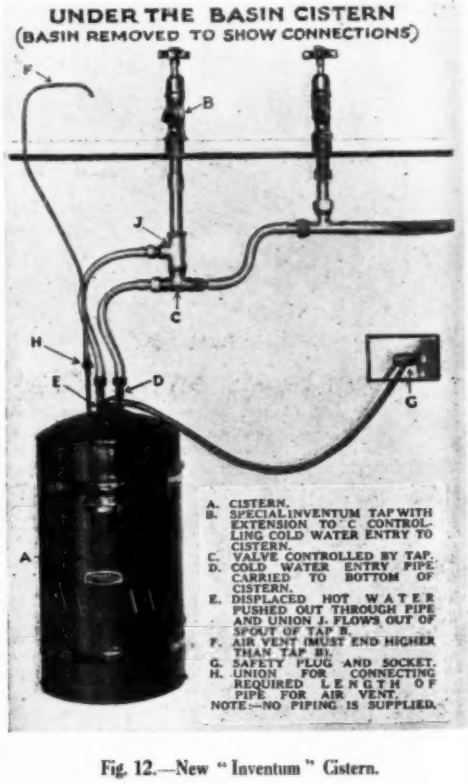

UNDER THE BASIN CISTERN
(BASIN REMOVED TO SHOW CONNECTIONS)
F
B
J
C
H
E
D
G
A
A. CISTERN.
B. SPECIAL INVENTUM TAP WITH EXTENSION TO 'C' CONTROLLING COLD WATER ENTRY TO CISTERN.
C. VALVE CONTROLLED BY TAP.
D. COLD WATER ENTRY PIPE CARRIED TO BOTTOM OF CISTERN.
E. DISPLACED HOT WATER PUSHED OUT THROUGH PIPE AND UNION J. FLOWS OUT OF SPOUT OF TAP B.
F. AIR VENT (MUST END HIGHER THAN TAP B).
G. SAFETY PLUG AND SOCKET.
H. UNION FOR CONNECTING REQUIRED LENGTH OF PIPE FOR AIR VENT.
NOTE:—NO PIPING IS SUPPLIED.

Fig. 12.—New "Inventum" Cistern.

exhibit was the "Under the Basin" cistern. This has been developed to meet the situation in cases where space shortage does not permit the use of the "Domestic" model. Fig. 12 shows the working arrangement of the apparatus. The special tap, which is fixed on the basin, controls the inlet of cold water into the cistern, and the hot water displaced flows out of the same tap. The capacity and loading of the apparatus are 1½ gal. and 500 W, respectively. It is supplied with a 3-pin plug and socket. The "Bath" 500-W cistern was also shown. This is intended for the small household where one or two baths are taken each day. It is provided with brackets at the back for wall fixing.

A variety of electric heating, cooking, and water-heating apparatus was to be seen at the display by MESSRS. BELLING AND CO. The electric cookers, vertical and horizontal, included some specially designed for hiring purposes. These are equipped with enclosed-type boiling plates, plug-in elements, and an enamelled hob. A number of new designs of electric fires, industrial and domestic, were also part of

the exhibit. A sectional view of a fire, showing the details of construction, attracted attention. Other apparatus exhibited included immersion heaters in actual use, and some new models of electric boiling plates and grillers. An efficient switch and interlocking plug-socket was shown.

MESSRS. L. G. HAWKINS & COMPANY, LTD., had a fairly comprehensive display of electric domestic apparatus, including cookers, washers, cleaners, ironers, percolators, and toasters. The "Electrolux" products, the cleaner and refrigerator, were on view at the stand of MESSRS. ELECTROLUX, LTD., who also had an enormous automobile model of the cleaner on view near the Opera House.

A wide range of electric domestic apparatus was exhibited by the BRITISH ELECTRIC TRANSFORMER CO., LTD. Included in the cookers was a new model, No. 722, which is designed to meet the requirements of 12 persons. It has a higher oven than its predecessor, No. 669, 18 in. instead of 14 in. Three boiling rings are fitted, as previously. The interior of the oven is in a removable-box form with a "dished" back and all-rounded corners. In all cases except the small model, No. 703, the Tricity cookers now have fuses and reciprocating switches in compartments under the hob.

A standard wash boiler seen on this stand has an element of the clamped type, a special method of stud reinforcement being a leading feature. The loading is 3.5 kW. The tap is at a suitable height from the ground, whilst its position in the container is such as to ensure all the water not being drawn off without the boiler being tipped forward.

A feature was a new breakfast cooker, shown for the first time. Of cast-iron throughout, this is a very strong appliance. Several designs of Sun Ray radiators were also shown.

The ELECTRICAL ASSOCIATION FOR WOMEN was represented by a stand with a collection of literature and particulars of the constitution and objects of the Association.

The Electricity Department of the Corporation of Buxton (Mr. A. Bishop, engineer and manager) had a stand setting forth the conditions of supply and a new tariff which is being introduced in the borough, including hire-purchase terms.

A striking exhibit was that prepared by the Electric Lamp Manufacturing Association, comprising features which were shown for the first time. We reproduce a photograph of one of these—a model engineering workshop, fig. 13, made by Messrs. Partridge's Models, Ltd., complete with miniature machine tools, hand tools, benches, &c., and equipped with two systems of lighting with tiny lamps, to

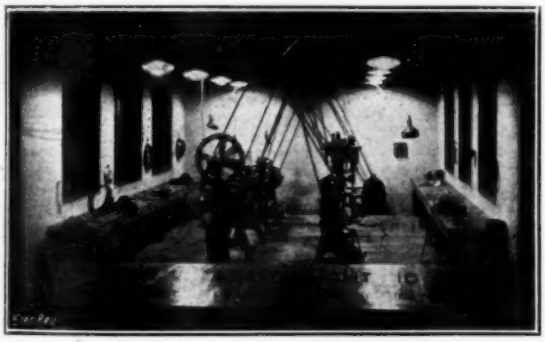


Fig. 13.—An E.L.M.A. Model Workshop.

show the difference between good and bad illumination practice. Other models for the same purpose represented a draper's shop-window and a business office.

Mr. GEORGE WILKINSON, M.I.E.E., in conjunction with Messrs. MEASUREMENT, LTD., had an interesting display of his patent "Losles" electric thermostats and water heaters, in operation, one set piece consisting of a fan and a radiator alternately cooling and heating a thermostat which alternately switched on one and the other in the vain hope of attaining a stable condition. The "Losles" thermostat has been greatly improved in design and construction since it was first introduced; experience has shown the weak points, which have been eliminated, the present pattern being very substantial and the regulation close; it is made in sizes from 5 to 30 A, and for voltages up to 500 V. One of the exhibits was a water heater of novel design; it consisted of a heating element immersed in oil in a copper tube, to be fixed at the bottom of a water tank. The oil forms the medium conveying the heat to the water surrounding the tube, and the variation of its volume with temperature serves to actuate a mercury switch controlling the circuit.

Messrs. BERRY'S ELECTRIC, LTD., in addition to their exhibit, opened a special showroom in the town, where an exact copy of the Duchess of York's fireplace was shown, as well as some score other patterns of the "Magicoal" fire, the McClary cooker, and other domestic apparatus. A centre of attraction after dark was a window arranged by E.L.M.A. to show a statuette with a background of drapery, illuminated from several concealed sources with ever-changing combinations of coloured light.

Messrs. W. T. HENLEY'S TELEGRAPH WORKS CO.'s travelling demonstration van, which we illustrated last year, was at Buxton, and was open for inspection.

A Large Electric Clock.

The tower clock at the new Canadian Houses of Parliament, Ottawa, is to be electrically operated, and will control the hour and quarter striking on the 53-bell carillon.

OF particular interest in connection with the new Canadian Houses of Parliament which are to be opened at Ottawa this year, is the electrically-operated clock with which the tower is being equipped. It is being installed by Messrs. Gillett & Johnston, Ltd., who are also supplying the large carillon of 53 bells in conjunction with which the electric clock will work.

The clock has four dials of bronze, glazed with white opal glass, each 15 ft. 9 in. in diameter. The hands are of copper, to the architect's design, while the motionwork is of the firm's standard construction. The motionwork wheels and also the nests of bevel wheels are constructed on the bed-plate

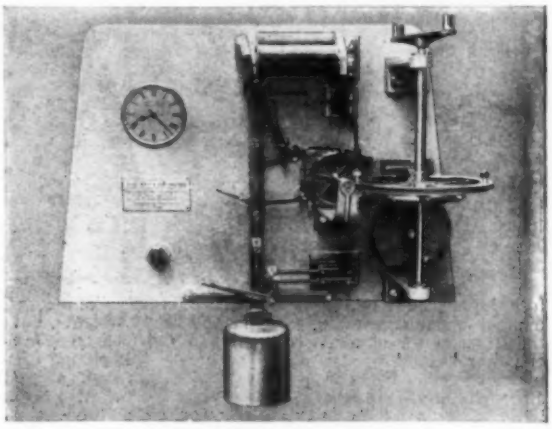


Fig. 1.—Clock Movement.

and plummer-block system, which gives great rigidity and accessibility for oiling and cleaning. The universal joints and connecting rods are all of unusually large scantlings, minimising the torque and back-lash, while still allowing for perfect freedom of action.

The timepiece portion of the clock movement, fig. 1, is of the Hipp type in its most modern and improved form. The motive power for the pendulum is obtained from accumulators used in the Parliament Buildings for other purposes. The current energises two very-large-capacity magnets which apply the driving power to the heavy pendulum with a smooth and silent action. When the arc of the pendulum falls to a predetermined amount, due to the work being done in turning

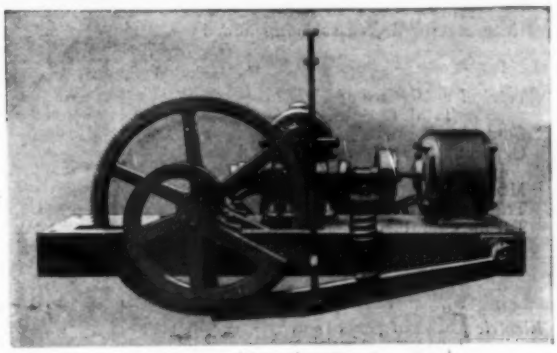


Fig. 2.—Striking Mechanism.

the hands, a wiper toggles in a steel notch and completes the circuit through the magnets, the impulse so given to the pendulum rapidly bringing this back to its maximum working arc. As a pendulum doing so much work cannot possibly keep accurate time, it is arranged that the hands reach each half-minute about 2 seconds in advance of the actual time, and that they are released by the impulse of the master-clock circuit exactly at each half-minute. An indicating dial in circuit with the master clock is incorporated in the design of the timepiece movement. All the parts are placed on the machined front surface of a deeply ribbed, vertical casting, and are well arranged for easy access. This timepiece is placed on a concrete base on the floor of the dial chamber in a glazed case.

The striking and quarter mechanism is fixed at a suitable lower level in the tower, beneath the heaviest bells. The striking gear consists of a cast-iron bed-plate on which is mounted a 1½-h.p. electric motor supplied from the 550-V,

2-phase, 60-cycle power mains. A single cam is driven by means of worm-wheel and spur reduction gear, and lifts the 560-lb. hammer (see fig. 2). Special automatic switchgear of a very simple and durable type is fitted for starting and stopping the motor, which is accomplished on the warning system by the closing and opening of a contact on the timepiece. The contact starts the motor, and a count wheel attached to the striking gear opens the switch for stopping the motor.

The Westminster quarter gear, fig. 3, is identical in action with the striking gear as far as the motor worm-gear and switch-gearing are concerned. Heavy steel cams operate the

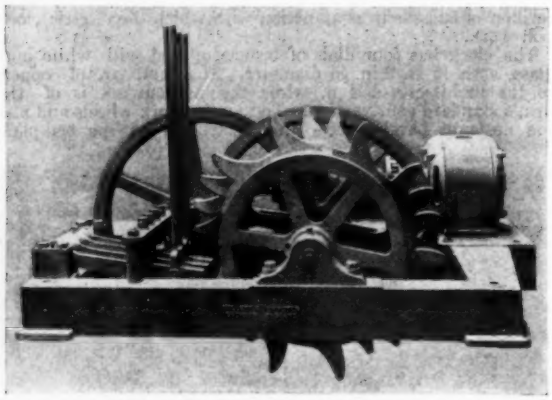


Fig. 3.—Quarter Mechanism.

forged quarter levers. The motor drive not only eliminates the manual labour of winding exceptionally heavy weights, but as the speed of the motor is constant and it has a large excess of power beyond what is actually required, the timing of the blows is claimed to be exceptionally crisp and accurate, although unusually heavy hammers of necessarily varying weights are in action.

The true Westminster quarters are played and the hours are struck on the bourdon bell of the carillon, which weighs 10 tons.

Indian Electrical Imports.

Figures for 1925-26 and 1926-27 Compared.

(FROM OUR INDIAN CORRESPONDENT.)

THE following are details of the imports of electrical machinery and apparatus into India during the year 1926-27, compared with the previous year 1925-26, notes of increases or decreases being added:—

	1926-27. Rs. lakhs.	1925-26. Rs. lakhs.	Inc. or dec. Rs. lakhs.
Electrical machinery of all kinds—			
Total	228	222	+6
Control and switchgear	32	36	−4
Generators, alternators and dynamos	49	42	+7
Motors	29	35	−6
Transformers	23	18	+5
Turbo-generator sets	8	28	−20
Other sorts	87	63	+24
From United Kingdom	186	184	+2
„ Germany	11	9	+2
„ United States	23	20	+3
Electric fans and parts thereof—			
Total	31	28	+3
From United Kingdom	21	16	+5
„ Italy	6	6	—
„ United States	1	2	−1
Electric wires and cables—rubber insulated—			
Total	29.81	37.32	−7.51
From United Kingdom	28	34	−6
„ Germany	1	2	−1
„ Netherlands	0.24	0.54	−0.30
„ United States	0.32	0.23	+0.09
Insulations other than rubber—			
Total	29	23	+6
From United Kingdom	26	21	+5
Bare copper wire (electrolytic), other than telegraph and telephone wire—			
Total	19.1	15.33	+3.77
From United Kingdom	16	12	+4
„ Netherlands	0.1	0.83	−0.73
„ Japan	—	0.50	−0.50
Telegraph and telephone wires and cables—			
Total	0.96	2	−1.04
From United Kingdom	0.83	2	−1.17
All electric wires and cables—			
Total	81.85	77.12	+4.73
From United Kingdom	71	68	+3
„ Germany	4	5	−1
„ Netherlands	2	2	—
„ Japan	0.4	0.84	−0.44
„ United States	4	0.28	+3.72
Telegraph and telephone instruments and apparatus—			
Total (mainly from U.K.)	4.75	7.67	−2.92
Electric glow lamps—			
Total	21	20	+1
From United Kingdom	8	8	—
„ Germany	1	1	—
„ Netherlands	8	6	+2
Electric lamps, other sorts—			
Total	10.93	4.22	+6.71
From United Kingdom	0.61	0.45	+0.16
„ Germany	0.69	0.51	+0.18
„ United States	9	3	+6
Parts and accessories of electric lamps—			
Total	7	3	+4
Batteries—			
Total	10	8	+2
From United Kingdom	4	4	—
„ United States	4	2	+2
Carbons, electric (including furnace electrodes)—			
Total	0.63	0.62	+0.01
From United Kingdom	0.40	0.41	− .01
Accumulators (including parts)—			
Total	16	11.88	+4.12
From United Kingdom	13	9	+4
„ United States	1	0.88	+0.12
Condensers, electric—			
Total	2	0.26	+1.74
Electric bell apparatus (not telegraphic or telephonic)—			
Total	0.7	0.17	+0.53
Electric lighting accessories and fittings (including switches)—			
Total	15.41	15.47	−0.06
From United Kingdom	11	9	+2
„ Germany	3	2	+1
„ United States	0.93	4	−3.07
Meters—			
Total	5.91	6.68	−0.77
From United Kingdom	5	5	—
„ Germany	0.47	0.93	−0.46
Electrical instruments (other than telegraphic and telephonic)—			
Total	2.68	4.21	−1.53
From United Kingdom	2	2	—
„ United States	0.23	2	−1.77
Electromedical apparatus (including X-ray apparatus)—			
Total	1.75	2.55	−0.80
From United Kingdom	0.45	1	−0.55
„ United States	0.60	1	−0.40
Switchboards (other than telegraph and telephone) —			
Total (mainly from U.K.)	4.13	3.15	+0.98
Electrical goods and apparatus, not enumerated—			
Total	37	30	+7
From United Kingdom	23	18	+5
„ Germany	6	5	+1
„ Japan	1	2	−1
„ United States	6	4	+2
Total of electrical goods and apparatus	251	226	+25
From United Kingdom	169	152	+17
„ Germany	22	22	—
„ Netherlands	10	8	+2
„ Italy	7	7	—
„ Japan	2	3	−1
„ United States	33	23	+10

Indian Duties on Battery Chargers.

By a recent ruling of the Indian Central Board of Revenue, battery chargers imported into India will be classed as machinery (subject to a 2½ per cent. duty) if they embody rotary convertors requiring more than 0.25 b.h.p., otherwise they are subject to a duty of 15 per cent. Battery chargers which employ transformers cannot be classed as machinery, and are subject to a 15 per cent. duty as "implements, instruments, &c."

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

Motor-Operated Rheostats.

A recent introduction of MESSRS. ERNEST F. MOY, LTD., Greenland Place, Camden Town, London, N.W.1, is a range of motor-operated rheostats specially designed for use in connection with remotely controlled switchgear. Fig. 1 shows a typical example of this equipment. This has a load capacity of 470-160 A, and a resistance of 1.1 ohms. The apparatus is constructed about an angle-steel frame on a cast-iron base,

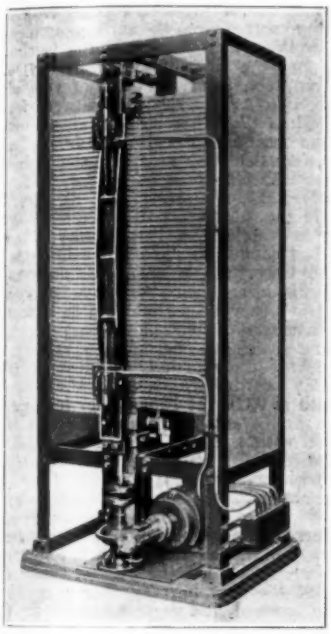


Fig. 1.—A Motor-Controlled Rheostat.

the sides and back being protected by perforated sheet-steel. The motor is housed in the base and drives the sliding brush vertically over the resistance contacts, by means of a square-thread screw and nut, through a totally enclosed worm gear. Limit switches are fixed at each end of the brush path, which stop the motor and leave it ready to restart in the opposite direction as soon as the control switch is reversed. The switches replace themselves automatically when the brush moves away from the end position. The resistance is in the form of nickel-copper wire clamped direct to substantial arms which form the switch contacts, so that no intermediate connections are used. The arms are carried on heavy slate bars mica-insulated from the frame. The apparatus can be made for any working capacity and voltage.

Lead Headed Nails.

We have received from Mr. T. F. SNOW, 247, Shakespeare Road, Loughborough Junction, S.E.24, some samples of lead-headed nails which he is producing, and which are claimed to be particularly useful in connection with the fixing of cables of electrical, telephone, and wireless installations. The new nails differ from the old type in that the tops of the heads are not covered, so as to avoid the hammer making contact with the lead and loosening it. The nails are made in six sizes, from 1 in. to 3 in. for wall fixings, and in two sizes, 1 in. and 1¼ in., for use on woodwork. The fixing tags vary from ⅜ in. to 1¼ in. in length.

The Empson Emulsifier.

The seasonal variation in supply and demand, the vagaries of the weather, and the prohibition of the use of food preservatives have hitherto militated against the general use of cream in restaurants, bakeries, and private households. Fortunately, however, a new method of dealing with the problem of cream supply has come to the fore, which consists in emulsifying the ingredients of natural cream, when and as required, by dissolving dried powdered milk in water, adding unsalted butter, heating the liquid in order to melt the fat, and then passing the mixture through an emulsifier, whence it issues in a condition ready for use. By this process cream of any desired thickness can be produced by simply varying the proportions of the ingredients; moreover, the cream can be "whipped" immediately it leaves the machine, without cooling on ice, and will keep for two or three days longer than natural cream. The complete apparatus, fig. 2, consists of a mixing tank fitted with an electric heater of from 1 to 4 kW, according to size, and a patented pump of special form, the whole being collapsible for cleaning purposes. The pump is provided with a screw propeller and guide vanes, and it lifts the solution from the bottom of the tank and discharges it over the surface, thus entraining the fat which tends to float; the device is more effective, and consumes less driving power, than the ordinary paddle stirrer, and it delivers the mixture to the emulsifier at a constant rate of flow and in constant proportion throughout the run, thus obviating hand regulation as the level of the liquid falls in the tank; its capacity is about 900 gallons per hour. The emulsifier consists of a disk-like high-speed rotating drum, made in three pieces and held together by a single nut, designed to produce violent turbulence, the liquid being forced to flow outwards through a series of "whirlpools" which cause intimate mixing. This vortex action constitutes the principal novelty of design, and is the subject of the main patent held by Capt. A. W. EMPSON, 26, Bridge Road, Taylor's Lane, Willesden, London, N.W.10.

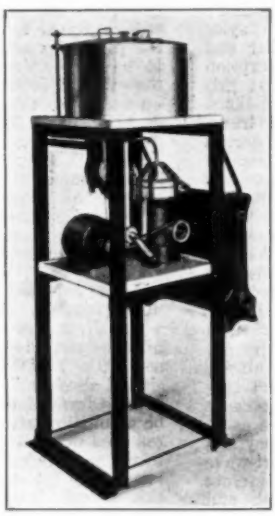


Fig. 2.—The Empson Emulsifier.

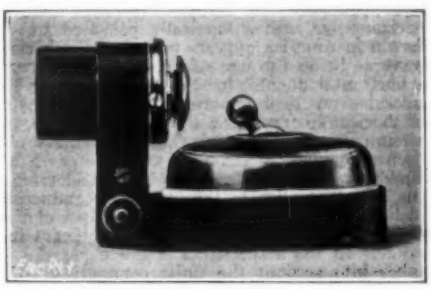


Fig. 3.—Switch Timing Attachment.

Actually the liquid passes through four vortices in series, involving seven abrupt changes of direction before the emulsion is discharged into the collecting chamber surrounding the drum, whence it flows over a cooler through which tap water is circulated. The E B-type emulsifier illustrated herewith, which should have many more applications than that mentioned above, will make from 1 to 5 gallons of thick cream at a time, and has a capacity of up to 20 gallons per hour; it is driven by an electric motor of only ½ h.p., which also drives the pump mixer in the tank. The base of the machine measures 20 in. by 24 in., and its overall height is 62 in.

An Automatic Switch-Timing Attachment.

An attachment for use with an ordinary tumbler switch, to allow switching-off to be done automatically after periods of from a few seconds to 15 minutes from the time of setting, has been placed on the market by MESSRS. F. A. WILKINSON AND PARTNERS, LTD., Gretton, near Kettering, Northamptonshire. It should prove useful in those cases where double-switching arrangements do not exist. Fig. 3 shows the device in position; it is not electrical and is merely clamped round the base of the switch. The device is operated by means of air pressure on a suitable piston. Operation of the latter throws the switch handle over at the correct moment.

The air is compressed by pushing the piston backwards till it is locked by a convenient catch. The release of the catch puts the piston and plunger in action. The time setting is effected by turning the knurled knob at the end of the plunger, a release valve being opened to an extent depending on the turn of the knob.

A Small Electric Cleaner.

An advertisement in *Electrical Merchandising* depicts a small electric vacuum cleaner, the "Presto-Junior," which is being marketed by the METAL SPECIALITIES MANUFACTURING CO., 338-350, North Dedzie Avenue, Chicago. It appears to be so arranged that the whole apparatus, driving unit, dust chamber, and accessories, is carried and operated by one hand, after the style of the whisk broom. This should prove particularly useful for cleaning staircases, &c. It is claimed that the appliance is capable of doing the work usually allotted to machines of the larger size.

Short-Wave Wireless Telegraphy.

A Novel Theory of the Skip Distance which agrees closely with the Observed Results.

By T. L. ECKERSLEY.

(*Review of a Paper read before the* WIRELESS SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE paper deals with the state of short-wave practice and theory, and describes experiments made in order to elucidate transmission phenomena, and certain theoretical developments based on the investigations. It involves a breakaway from the traditional views of simple ray refraction, which reflects the essential divergence of the ideas presented from those previously published; the diverse systems in use indicate how far we are from finality in this matter. The ray theory, developed from the original work of Eccles and Larmor, has been pursued to the bitter end in this country, but is by no means universally accepted; Dr. Meissner, in particular, has developed another theory based on experimental transmission to Buenos Aires. In the author's opinion the ray theory as developed by Americans (Taylor and Hulbert, Heising, Shelleng and Southworth, Baker and Rice) neglected the very important factor of the absorption of energy in the ray, and he attempts to show that this theory plays a dominant part in practically all transmissions. His experiments should throw light on the nature of transmission as well as on the practical design of suitable aerials for short-wave working. Theory and practice are inextricably involved in this latter question: for instance, it has been proposed to use aerials which radiate their energy upwards in order to take advantage of the reflection from the Heaviside layer; Marconi's Co. favours the beam radiating more or less horizontally, with a vertically polarised wave, while Alexanderson in America appears to regard the horizontally-polarised wave as being the more favourable for transmission, and uses a horizontal doublet for the purpose. It is therefore of considerable practical importance to decide whether the vertical or horizontal rays are the more effective, but in previous attempts to calculate polar diagrams the problem has always been simplified by assuming that the earth is a perfect conductor, which may lead to very considerable errors, because the corrections due to the imperfect conductivity of the earth include terms which involve the product of the frequency and resistivity, and therefore become significant in the short-wave range. In the first section of the paper the author therefore takes into account the finite conductivity of the earth and calculates the approximate polar diagram for the case of a vertical doublet situated at a height above the surface of the earth. An immediate consequence of his theory is that the aerial radiates practically nothing horizontally (except in the immediate neighbourhood of the transmitter), for when the earth is not perfectly conducting, the absorption of the rays propagated horizontally is so great that all the lower rays are more or less completely absorbed, which is a radical departure from preconceived ideas. It is shown that the intensity of low-angle transmission is increased by raising the transmitting aerial; but, on the contrary, for high-angle transmission, a half-wave aerial situated near the earth's surface is practically as good as any other.

In order to make practical use of this we require a knowledge of the best angle of elevation for transmission over any required range. In the next section of the paper an account is given of direction-finder experiments designed with a view to the determination of the nature of transmission on short waves; in particular the angle of incidence of the incoming (and therefore by the reciprocal theorem the outgoing) rays is studied, the conclusion being reached that in long-distance transmission the ray trajectory has a shallow angle of elevation, 15 deg., and follows the great-circle path.

The third section of the paper contains the results of a series of long-distance transmission tests; waves between 25 and 10 m. were used, and experiments were made which indicated the superiority of a raised doublet over one at the ground level.

In the last section the general theory of ionic refraction is discussed in the light of these and other experimental results. The effect of attenuation due to the collision of electrons with molecules is especially stressed, and a novel theory of the skip distance is put forward which has the merit of agreeing closely with observed results.

The ray theory has been successfully used to explain and compute the "skip distance," the evidence for the existence of which effect has been largely accumulated by Hoyt Taylor in America. It seems to be an undoubted fact that in the neighbourhood of a short-wave transmitter, signals drop in intensity very rapidly with distance, may disappear entirely at distances of 100 or 200 miles, and then begin to increase again to a maximum and finally die away at very great distances. The distance skipped in this way appears to depend on the wave-length, season, and local time. It increases with increasing frequency, is greater at night than in the day, and in winter than in summer. The suggestion is, of course, that the greater the frequency is, the less the bending and the further off the main target of the rays.

If we consider the sheaf of rays sent out by the transmitter, the lower-angle rays find their target at a great distance; as the angle is raised the target point approaches to some minimum value d_1 corresponding to some angle θ_1, and as the ray angle is still further increased the target point recedes again until at $\theta = \theta_2$ the ray escapes from the earth altogether. By making certain assumptions with regard to the heights of the refracting layers and the distribution of density in them, chiefly chosen, it appears, from the point of view of mathematical convenience, that good agreement between the calculated and observed values of d_1 has been obtained; but when it comes to comparing observed and calculated *intensities* the picture presented by the calculation seems to the author to be very wide of the mark. One consequence of the ray theory that is significant is that, apart from the direct ray, absolutely nothing should be obtained within the "skip distance," and that there is practically a discontinuity at the skip distance. In actual fact conditions are nothing like this. Heising, Shelleng and Southworth have made simultaneous measurements at various distances from short-wave stations working on 66 and 44 m. and, beyond a slight dip at regions of about 150 miles, there is no sign of a complete disappearance and sudden commencement of signals beyond the skip distance; in their measurements there is only an increase of about 10 to 1, which may possibly be exceptional. If we take the change in strength at AGB (at Nauen), for instance, during the late afternoon and evenings, as an indication of a transition into the region within the skip distance, as night falls the roughly measured intensity change may be as much as 1,000 or 10,000 to 1; but whatever amount the ratio of intensity of the signals within and without the skip distance may be, the form of the intensity diagonal distance curve seems to be a smooth curve, and there is every indication of high-angle reflected or scattered energy within the skip distance, contrary to the ray theory. The author feels that he will be guilty of suggesting the heresy that the escaping ray theory of the skip distance is by no means proved, and suggesting an entirely different alternative theory.

The only evidence we have is that within the skip distance the indirect rays (reflected or refracted) are either not present (complete skip), or are present with very diminished intensity. We know that the high-angle rays do not get back to earth, but this does not prove that they escape—they may be absorbed in the upper regions of the atmosphere; if this is the case the estimates of the minimum wave-length (for long-distance transmission) based on a supposed maximum density, are absurd. In order to compare them with Heising, Shelleng and Southworth's actual measured values of the density in the region of the "skip" distance, the results of the author's computations are reproduced (in the original paper) in the form of curves in which intensity is plotted against distance. The general form of the two are similar, but the calculated intensities at 300 miles and over are in general too great; if we assume that there is a lower fringe to the layer, slightly ionised and reaching down to levels of 15 to 20 km., there will be added attenuation practically proportional to the range which will be responsible for the major portion of the long-distance attenuation and which will tend to better the agreement between the observed and calculated characteristics. Similar arguments apply to night transmission, where there is the additional evidence of a low-density fringe in which the "squeak X's" are produced. The author's view of the two layers is this: a lower daylight layer is situated in regions between 50 and 70 km. from the earth, in which the density increases so rapidly with level that there is very little penetration (for long-distance glancing-angle incidence), with a lower fringe (of small electronic density) in which the main long-distance attenuation, which must be present, occurs. The path of the ray through the lower fringe (over long distances) will, in general, be more or less independent of the wave-length, so that attenuation will be characterised by a falling off in proportion to the square of the frequency, as has actually been found in the short-wave range. Similar considerations apply at night time, with added complications due to the rotation of the plane of polarisation as the ray travels along the earth's magnetic field, and of the double refraction effects due to the same cause.

This theory seems to the author to be capable of dealing with, and explaining, a very much wider range of facts than the simple ray theory; in particular it links long- and short-wave transmission in a perfectly reasonable way, and accounts for the contrast in long- and short-wave daytime transmission characteristics, in respect of seasonal and magnetic disturb-

ance effects. It naturally explains the increase of range with frequency (short-wave day transmission) and requires a plausible constitution of the upper layers in agreement with the evidence from other sources (in particular diurnal magnetic variations) and leaves no important fact unexplained.

It seems to be an undoubted fact that there is a short-wave limit below which it is impossible to get long-distance transmission. It seems probable that the limit for night transmission is in the neighbourhood of 17 m., although the echo effect seems to show that under certain conditions waves as short as 14 or 15 m. may get through 20,000 km. of darkness.

In daytime the short-wave limit does not seem to have been reached at 10 m. A recent experiment on 8 m. (using the same transmitter and power as in the other short-wave experiments) seems to indicate that this is below the limit, as nothing was received in Sydney, Montreal, New York or South Africa, so that the limit appears to lie between 8 and 10 m. This short-wave limit has received a very natural explanation on the ray theory, *i.e.*, it is supposed that the density in the upper layer is not sufficient to bend even the horizontally-transmitted rays back to earth, so that all the rays escape. The author is not inclined to accept this explanation, chiefly on the ground that there is evidence of high-angle rays, within the skip distance, of even the shorter waves (20 to 25 metres), which on the ray theory should be entirely absent; or we may put it in another way: observations within the skip distances suggest very strongly that the layer is rich enough in electrons to bend even the high-angle rays back to earth, but, of course, with much diminished intensity.

In the calculations for the skip distance the attenuation in the main layer for small angles of elevation, and for a sufficiently long wave-length (some 40 m.) (apart from the lower fringe) was found to be so small as to be negligible (actually the attenuation should have been greater, on account of the increased ray length in the layer occasioned by the earth's curvature) because at these glancing angles (and for sufficiently long wave-lengths) the penetration and ray path in the main layer is so small as to introduce but little attenuation; but, as the wave-length is reduced, the penetration and ray length in this layer rapidly increase and will reach a stage at which attenuation begins to be important, so that for sufficiently short waves the rays will be able to penetrate this layer and not get out again even at glancing incidence.

The picture that the author has of transmission on different wave-lengths is this: For waves above the limiting wave-length this attenuation constant is small, and long-distance glancing-incidence transmission takes place in the space between this main layer and the earth. Penetration into the main layer is small, and the whole attenuation is small and caused by the sparsely populated fringe below the layer, but directly the wave-length is made shorter than this short-wave limit, and the main ray penetrates well into the main layer, absorption sets in and further long-distance transmission is impossible. This theory applies to both day and night transmission with suitable values for τ in each case. This is essentially a modified form of layer theory.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

A Radio-Telephone Loud-Speaker.

I have read with considerable interest the article on this subject by Mr. E. W. Braendle, A.M.I.E.E., in the current issue of the REVIEW. Since it appears that Mr. Braendle claims to disclose the construction of a speaker which will give very good reproduction, sufficiently good, in fact, to do justice to the quality of the B.B.C. transmission, I venture to suggest that on his own showing his speaker does not fulfil these conditions, and I think many readers would be glad to learn his justification for various statements.

First of all, "mobility" and "rigidity" of cone diaphragms are mentioned: I should like very much to learn what is indicated by these two terms, and in what way they are desirable or undesirable features of a diaphragm. Next, Mr. Braendle makes not the slightest reference to the drive and its influence upon the diaphragm, and the correlation of the two. The type of drive employed cannot possibly energise the diaphragm so as to give an even response over a useful frequency band. Space does not permit me to explain why this is so, but readers who are unfamiliar with such matters can refer to the subject in a standard text-book.

Perhaps the most amazing point in Mr. Braendle's article is the curve, fig. 6, showing, apparently, the impedance of the windings of the speaker at various frequencies. In the first place, let it be most emphatically stated that the most useful form of loud-speaker curve is one showing audio response plotted against frequency. Another extraordinary point is that this curve is taken only across a very small frequency band, *i.e.*, frequencies from about middle C to about 2¼ octaves above middle C, that is, roughly, 250 to 1,500 cycles. Over this very small compass the impedance of the windings varies from 8,000 to 35,000 ohms; but, as previously mentioned, this type of curve indicates very little of the performance of the speaker. If, then, Mr. Braendle intends us to infer that the usefulness of his speaker is represented by these graphs, we may assume that it gives substantially no bass. So far as the treble is concerned, the curve still seems to be rising; therefore it is not possible to infer what happens.

My own experience of commercial loud-speakers leads me to believe, when comparing them with that of Mr. Braendle, that his speaker falls far short of some of the best cone balanced-movement-driven speakers. I happen to have a very accurate response curve showing loss or gain in T.U. in the response of a well-known commercial cone, which reproduces fairly evenly over a band extending from approximately 50 to 5,000 cycles. In the case of a coil-driven speaker the response is substantially perfect, and on one laboratory model frequencies as low as 25 cycles can easily be reproduced. This means, of course, that the speaker can reproduce the lowest organ notes, whereas on many types, and, I would suggest, the one under consideration, they would be entirely absent. Perhaps Mr. Braendle would be good enough to explain the various points which I have raised.

Paul D. Tyers.

Watford, *June 6th*, 1927.

Single-phase Induction Motor Starting Devices.

The remarks of Mr. W. S. Daniels in his discussion of my recent article on the above subject are rather difficult to understand.

If Mr. Daniels reads through the article carefully he will find no claim that the Ferraris-Arno method of working is a new one, and therefore the historical information given in his letter is rather superfluous. In fact, I should expect that anyone possessing any knowledge of the system at all would fully appreciate the fact that it was developed during the early times of motor development.

My object in writing about the Ferraris-Arno system is fully set out at the commencement of the article, which was intended for the average engineer not possessing, or interested in, the information relating to patents given by Mr. Daniels, and I can therefore only conclude by thanking Mr. Daniels for bringing to my notice Hobart's "Electric Motors," which I had overlooked at the time of writing the article.

G. Windred.

London, *June 11th*, 1927.

A Commutation Problem.

Please allow me to thank Messrs. H. Joseph and P. Oaks for their views on the above problem. Regarding Mr. Joseph's suggestion of the trouble being mechanical, it is not so, as the commutators were certainly faultless in this respect, and I feel confident that the responsibility lay on the electrical design.

In explanation of my suggestion that the conductors were 7½ degrees out of place, I may be wrong, but the following is my reasoning: there are 12 slots and 24 commutator bars; in each half-slot (top or bottom) there are 2 coil sides, A and B, taped together. If the brushes be set so that the A wires are exactly right for commutation, the B wires, which, according to their commutator bars, should be 360/24=15 degrees ahead, or behind, are to that extent wrong, as their average position is the same as the A conductor, being mixed up, or "mushed," with them.

The idea was that in practice the brushes would be adjusted so that instead of A being right and B 15 degrees out, each would be 7½ degrees each way, and this is the best obtainable.

Briefly, even if by subdividing the coils as above, the reactance is sufficiently reduced so as to obviate sparking from that cause, there is a lower limit to the number of slots, due to the above reasons.

A. D. Griffiths.

Caergwrle. *June 10th*, 1927.

The Ideal Wiring System.

My attention has been called to a letter on page 910 and to an editorial note thereon. The suggestion is that a lead-covered cable in contact with perfectly dry plaster can be corroded by the plaster. I think it may be stated with absolute certainty that no chemical action could take place under such circumstances.

With regard to the last lines of your editorial note, I do not think any cable maker would subscribe to the statement that it is well known that lead sheathing should not be laid in contact with plaster. Practically all lead-covered surface wiring systems are in contact with plaster, and corrosion is practically unknown; notwithstanding the statement that the lead-covered cable in question was perfectly bonded, all investigations so far have shown that chemical action between lead and plaster is due to electrical leakage and points to imperfect bonding.

L. B. Atkinson.
THE CABLE MAKERS' ASSOCIATION.

London, *June 10th*, 1927.

Power Supply for Wireless Sets.

I read with interest the article by "G. F. J." on his experiences with eliminators for a.c. mains, and I wondered if any of your readers had tried ordinary "power" valves for this purpose, using them with the grid and plate joined. I have an eliminator using a "Stentor Four" valve and the output is:—11 mA. at 220 V, 18 mA. at 180 V, and 30 mA. at 120 V, these figures being obtained with the filament run at only 3 volts. I think this is as good a performance as those mentioned by your contributor; it could no doubt be improved on by running the filament at its normal 4 volts, or by using valves of the "super power" class.

F. B.

June 12th, 1927.

Metal-clad Draw-out Switchgear.

The article by Mr. T. Carter on the above subject in your issue of May 27th, far from being a comparison of the horizontal and vertical types, appears actually to be a eulogium in one definite cause, the supporters of which might have become restive due to the ramifications of the manufacturers of the vertical units. Certainly any intelligent engineer, if he had the patience to read the whole of the article, would lay it aside with the conviction that Mr. Carter had failed in the object for which he set out, that is, to have us all believe that the horizontal draw-out type of unit is the embodiment of everything that is perfect.

If, as I believe to be the case, Mr. Carter resides in the Newcastle district, he will undoubtedly have had abundant opportunities of thoroughly examining that type of switchgear which he prefers, and having, so to speak, been brought up in its neighbourhood, one can understand his preference.

The first portion of his closing paragraph reads as follows:—

> "If I have succeeded in expressing myself as I have wanted to do, I will have made it clear that the balance of advantage lies with the horizontal type *for small and moderately large units.*"

This, in my opinion, amounts to a complete refutation of the advantages which Mr. Carter is careful to assign to the horizontal type of unit, as clearly the question of suspended weight, accessibility, and compactness in the case of the vertical type, is of far less moment in relation to small and moderately large units, than with the very large sizes.

Mr. Carter may be certain of one thing, namely, that where the makers of the vertical type claim weatherproofness, capability to deal with short circuits, and any other attribute which is inherent in that particular design, they will have taken great care to ensure that their claim is a sound one, and not merely made regardless of truth.

The best answer to Mr. Carter's apparent condemnation of the vertical type of unit is the enormous number of these units which are being continually manufactured.

There are occasions when horizontal gear is preferred to vertical gear, and *vice versa*; why not let it rest at that without "trumpeting" one type to the detriment of the other?

W. B.

Manchester, *June 9th*, 1927.

Reviews.

The Practical Telephone Handbook. Seventh edition. JOSEPH POOLE, A.M.I.E.E., Wh.Sch., and others. Pp. xxv + 870; figs. 687. London: Sir Isaac Pitman & Sons, Ltd. Price 18s. net.

The fact that this handbook, which is really a compilation of the work of a number of writers, has reached its seventh edition shows that it has not lost in popularity as time goes on. One of the earliest of manuals devoted exclusively to telephone matters, it has maintained its place as a student's text book on that subject for many years, practically unchallenged. The present edition is a revision of the previous one, which has been increased by the addition of 146 pages and over 100 illustrations. Several of the chapters have also been wholly rewritten. The fact that the author and his coadjutors are on the staff of the British Post Office may be taken as a sufficient guarantee of their ability to provide the reader with reliable descriptions of the standard practice which has been adopted in this country. There are, in all, thirty-seven chapters dealing successively with batteries, receivers, transmitters, sub-station apparatus and instrument connections, intercommunication, switchboard apparatus, relay and lamp signalling, P.B. exchanges, magneto exchanges, common battery systems, junction line working, trunk and party line working, power plant, aerial and underground construction, loaded lines, multiplex telephony, submarine telephone cables, testing, telephonic repeaters, wireless telephony, automatic exchanges, and traffic and development studies; from which it will be seen that the writers have covered a somewhat extensive field within the scope of one volume.

In the chapter dealing with secondary batteries the old chemical formula for discharge is still retained, no mention being made of Fèry's equations representing the actions of charge and discharge which it is usual to give as an alternative, if not a more correct, explanation of what takes place. It would also be interesting to know how the empirical formula for the ampere-hour capacity of a cell is arrived at.

The chapter on receivers and transmitters is well up to date. In the latter class a brief but suitable description is given of the 2 L.O. broadcasting transmitter.

Additional matter has been added to the previous work on exchange working, particularly in the case of junction and trunk line developments. This was rendered necessary by the interposition of automatic with manual exchanges.

Chapter XXXII on telephone repeaters, although necessarily restricted to a general outline of the methods employed, will, nevertheless, give the reader an accurate knowledge of this recent and important branch of telephony.

It is stated that there are large numbers of trunk circuits up to 200 miles in length which consist of two-wire repeater circuits working on 20 lb. and 40 lb. conductors, instead of 100 lbs. upwards to 800 lbs. per mile as in the case of aerial trunks not furnished with repeaters. This is economy indeed.

The chapter on wireless telephony gives a fairly adequate account of the methods and progress in this field. The theory of the action of the two-electrode and triode valves is given, and also an explanation of the method of heterodyne reception. The transmitting arrangements at Daventry broadcasting station are described and a simplified diagram of the circuits is appended.

Automatic telephony occupies over 100 pages of the book and is probably the most important feature of the work.

Descriptions are given of the various systems now in operation, including the "Directer" system, which has been adopted for the London district, and a number of excellent inset diagrams are given. It is observed, however, that fig. 647 is missing and has not been inserted between pages 772 and 773 as stated on page 769.

The book closes with a chapter on miscellaneous applications, including a description of the structure and operation of the modern loud speaker, and a series of useful tables is given in an appendix.

As a practical handbook on the subject of telephony the book justifies its recommendation as a suitable text-book for the City and Guilds of London Examination in that subject.

Electrical Condensers. By PHILIP R. COURSEY, B.Sc., F.Inst.P., M.I.E.E. Pp. xxiv+637; figs. 514. London: Sir Isaac Pitman & Sons, Ltd. 1927. Price 37s. 6d. net.

The author of this book draws attention in the preface to the remarkable development which has taken place in the use of condensers during recent years, both in the sphere of radio communication and also in that of heavy electrical engineering. The extensive field of application of the electrical condenser renders a work of the kind under review very opportune. The author has treated his subject on a very broad basis, the matters dealt with ranging from the theory of the dielectric circuit, to details of manufacture of condensers for industrial purposes.

The opening chapter deals with the fundamental properties of the condenser and with its behaviour on both d.c. and a.c. circuits. After a historical survey of the development of the condenser, the author proceeds to deal in detail with the properties of dielectrics, with the measurement of these, and with the important subject of dielectric losses. A chapter is devoted to the calculation of the capacities of condensers of various types from their geometrical properties. As the author generally starts from basic principles in his theoretical investigations, we think that the derivation of the constant for the conversion of capacities from electrostatic to electromagnetic units might have been given. The subject of this chapter is continued to the calculation of the capacity of overhead lines, aerials, and underground cables. The reference to the latter is very slight, and the difficulties attendant upon the use of insulated cables, at pressures above 22 kV, are merely the subject of a passing notice. A lengthy chapter of a descriptive nature deals with the use of condensers for radio work, this being followed by a detailed treatment of the design of condensers of this description. A good chapter follows on the measurement of capacity, in which the theory of the various methods available is fully worked out, and the practical details of the several tests are adequately set out. In the chapter on variable condensers for radio work the author discusses very fully the problem of the design of condensers in which the capacity is a required function of the displacement of the movable member. A number of descriptive chapters follow, in which the details and manufacture of condensers with air, glass, paper, mica, and liquid dielectrics are very fully dealt with. The use of condensers for protection against over-pressures in high-tension transmission systems is described, and there is a brief chapter dealing with the use of condensers for the correction of power factor in industrial a.c. supply circuits. This last chapter is little more than a brief sketch of the subject, and in a work of this character might with advantage have been considerably amplified. The reference to the synchronous condenser is rather misleading. The function of this machine for power factor correction is so different from that of the static condenser, and its property of having the wattless current supplied under easy, or even automatic, control is so valuable that a comparison of the two types is hardly possible. A remarkable feature of the work is the lengthy

bibliography, extending to no fewer than 100 pages, and containing over two thousand references.

Mr. Coursey's book will, perhaps, be of greater interest to those concerned with radio work than to power engineers; the bias, as would be expected from the professional connections of the author, tending decidedly in the direction of the former field. As a work of general reference it will be of considerable value to all engineers, but we fear that the scope of its appeal will be somewhat restricted by its high price.

Notes on Electricity as Applied to 1926 Artillery. Pp. vii+254; figs. 86. London: H.M. Stationery Office, 1927. Price 2s. net.

This little work is intended as a handbook of instruction relating to the various apparatus used in the Artillery Service, and it is prefaced by an account, in simple, non-mathematical language, of elementary electrical theory. The first part of this theoretical section deals with the effects of electricity, and with the simple properties of electrical circuits. In the effort to compress a wide subject into a restricted compass, conciseness is sometimes obtained at the expense of clearness. The last sentence on p. 39 is ambiguous in that it appears to imply that a direct current cannot be produced by electromagnetic induction; whilst the explanation of virtual values of alternating quantities given in the footnote on p. 40 is far from happy. The customary term, impedance, is preferable to "apparent resistance" for the quotient of volts by amperes in an alternating-current circuit, and this latter expression is better used for the quantity, volts^2/watts, which in a circuit embracing an iron core, is different from the actual resistance as measured by direct-current methods. Part 2 deals very satisfactorily with the construction and principles of operation of simple direct-current instruments, with the measurement of resistance, the theory and use of the potentiometer, and with the use of the detector for simple testing. Part 3 deals simply with primary and secondary batteries, wiring, telephones, and electrical machinery. In the diagram, on page 75, of the method of charging an accumulator from the supply mains, the battery is shown connected in the positive main of a two-wire system. A note should have been made of the desirability of inserting the battery in the earthed pole when the direct-current supply is obtained from a three-wire system.

The last section of the book deals with the details of actual Service apparatus, and sets out full directions for its use. The very full accounts of various telephone equipments will be found of considerable use, and a lengthy description of the Fullerphone is included in this section. The book concludes with a number of questions involving simple arithmetical work; references are made to the several paragraphs in the book which these questions are intended to illustrate, and the answers to the questions are given. It seems rather a pity that the latest suggestion of a capital "omega" as a symbol for "ohms" is not used, instead of the obsolete and inconvenient "O."

Although we have had occasion to offer a few criticisms on relatively minor matters relating to this book, we are pleased to say that it has been very well and skilfully written to meet the needs of those approaching the study of electrical matters for the first time. We think that the book will be found very useful to elementary technical students, wiremen, and telephone linesmen and maintenance men who require a simple account of the rudiments of electrical theory, instruments, measurements, and signalling apparatus.

Television. By A. DINSDALE, A.M.I.R.E. Pp. 62; illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. net.

In this little book the author outlines the history of "television," which he defines as "vision by telegraphy"—certainly not a sound or appropriate expression, as in television there is no permanent record of the images transmitted. He explains the nature of the problem to be solved, and briefly describes the earlier attempts to overcome the great difficulties that were met with, leading up to the Baird "Televisor," which is dealt with as fully as circumstances permit. The treatment of the subject is highly optimistic, the author being an enthusiastic admirer of Mr. Baird's achievements, which he regards as successful, though he admits that "at present the transmitter has not emerged from the laboratory"; progress is "continuing at a rapid rate," and we hope that eventually the inventor's dreams will be fully realised.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

32,444. "Telephonic receivers." M. Graham, A. Graham (legal representatives of E. A. Graham, deceased), and W. J. Rickets. December 23rd, 1925. (Cognate application 32,938/25.) (271,125.)

32,491. "Control of electric orchestral instruments of the organ type." A. Barbieri. December 23rd, 1925. (271,126.)

1926.

1,427. "Telephone systems." Standard Telephones & Cables, Ltd., A. M. Searle, and J. H. E. Baker. January 18th, 1926. (271,128.)

1,765. "Arrangements for actuating apparatus by telegraphic and like light current impulses." E. O. Symonds. January 21st, 1926. (271,129.)

3,753. "Television and like apparatus." R. S. Clay. February 9th, 1926. (271,131.)

3,952. "Smoothing or filter circuits for use in conjunction with thermionic valves." R. S Atherstone. February 11th, 1926. (271,132.)

4,295. "Variable electric condensers." R. Woods. February 15th, 1926. (271,137.)

4,337. "Wireless receiving instruments and loud speakers or other telephone receivers." R. H. Coaks. February 15th, 1926. (271,139.)

4,417. "Circuit arrangements for selectors in automatic and semi-automatic telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. February 16th, 1926. (271,142.)

4,480. "Discharge tubes having an enclosed arc discharge." H. Wade (Naamloore Vennootschap Philips' Gloeilampenfabrieken). February 16th, 1926. (271,144.)

4,594. "Electric reading lamps." R. Kaplan. February 17th, 1926. (271,148.)

4,633. "Two-way terminal adaptor switch." F. G. Woodall. February 18th, 1926. (271,150.)

4,684. "Protective arrangements for a.c. electric circuits." A. Reyrolle and Co., Ltd., and R. W. Biles. February 18th, 1926. (271,153.)

4,715. "Telegraph systems." Automatic Telephone Manufacturing Co., Ltd., and H. H. Harrison. February 18th, 1926. (271,155.)

4,820. "Thermostatic regulation of current flow in electric currents." General Electric Co., Ltd., A. Kinnes, and M. H. Hunt. February 19th, 1926. (271,158.)

4,883. "Direct-current rotary transformers with arbitrarily variable subdivision of pressure." A. Della Riccia. February 19th, 1926. (Addition to 172,969.) (271,161.)

4,884. "Direct-current rotary transformers with arbitrarily variable subdivision of pressure." A. Della Riccia. February 19th, 1926. (Addition to 172,969.) (271,162.)

4,898. "Tuning wireless circuits." J. Vaughan-Sherrin. February 20th, 1926. (271,163.)

4,962. "Tanks for electrical apparatus." A. W. G. Tucker and Ferranti, Ltd. February 20th, 1926. (271,168.)

5,175. "Tuning of electric circuits containing relays or other electro-responsive movable devices." Westinghouse Brake & Saxby Signal Co., Ltd. May 21st, 1925. (252,325.)

5,302. "Telephone systems." Standard Telephones & Cables, Ltd., and E. P. G. Wright. February 23rd, 1926 (271,176.)

5,582. "Electrical terminals." R. E. Worsley. February 27th, 1926. (271,180.)

6,379. "Rotary electric switches." Oliver Pell Control, Ltd., and C. Oliver. March 8th, 1926. (271,191.)

6,866. "Receiving apparatus for wireless telephony and telegraphy." G. King. March 12th, 1926. (271,197.)

8,064. "Loud-speakers and like sound-reproducing devices." V. Himmer. March 24th, 1926. (271,207.)

8,530. "Manufacture of electrodes, welding rods, and the like." B. Turner and Ferro-Arc Welding Co., Ltd. March 29th, 1926. (271,209.)

8,542. "Thermoelectric cooking ovens." S. Sacerdote. March 29th, 1926. (271,210.)

9,227. "Batten lights and footlights." Holophane, Ltd., and R. G. Williams. April 7th, 1926. (Cognate application 259/27.) (271,212.)

9,431. "Daylight lamps." A. C. W. Aldis. April 9th, 1926. (271,213.)

9,868. "Thermionic valve amplifying systems." British Thomson-Houston Co., Ltd., R. C. Clinker, and G. S. C. Lucas. April 14th, 1926. (Cognate application 11,442/26.) (271,222.)

10,219. "Vibration-resisting filaments for electric incandescent lamps and similar devices and method of making the same." British Thomson-Houston Co., Ltd. April 17th, 1925. (250,974.)

10,912 "Condensers for use in radio signalling apparatus and the like." R. Hodson. April 20th, 1926. (271,229.)

11,629. "Electromagnet switches or relays." General Electric Co., Ltd., A. Kinnes, and M. H. Hunt. May 3rd, 1926. (271,235.)

11,867. "Electric circuit-breaking apparatus." English Electric Co., Ltd., and R. A. R. Bolton. May 6th, 1926. (271,238.)

13,709. "Electromagnetic sound-reproducing systems." Brandes Laboratories Inc. January 28th, 1926. (265,123.)

14,483. "Radio receiving apparatus." Igranic Electric Co., Ltd., and P. W. Willans. June 8th, 1926. (271,253.)

14,948. "Frame and other closed aerials." Burndept Wireless, Ltd., C. F. Phillips, and P. K. Turner. June 14th, 1926. (271,257.)

15,157. "Direct-current dynamo-electric machines." G. A. Juhlin and Metropolitan-Vickers Electrical Co., Ltd. June 16th, 1926. (271,261.)

15,374. "Screen for telephones." E. L. Dunand. June 18th, 1926 (271,262.)

16,292. "Telephone plugs and the like." E. Whiteley. June 28th, 1926. (271,271.)

18,778. "Electric switches." G. B. Handley and C. H. Parsons, Ltd. July 28th, 1926. (271,288.)

19,739. "Watertight electric blasting fuses." N. Schmitt. August 10th, 1926. (271,295.)

19,936. "Resistance thermometers." W. H. Apthorpe and Cambridge Instrument Co., Ltd. August 12th, 1926. (271,296.)

21,973. "Sound amplifiers." R. H. A. Englund. September 6th, 1926. (271,307.)

22,345. "Electrical condenser." Dubilier Condenser Co. (1925), Ltd. October 31st, 1925. (260,555.)

22,862. "Thermionic valve amplifying systems." British Thomson-Houston Co., Ltd. November 14th, 1925. (261,343.)

24,317. "Electric motor control systems." British Thomson-Houston Co., Ltd., and E. B. Tuppen. October 1st, 1926. (271,313.)

25,064. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. January 12th, 1926. (264,451.)

25,728. "Electric relays." Automatic Telephone Manufacturing Co., Ltd., and R. W. Tarrant. October 15th, 1926. (271,318.)

26,994. "Electromagnetic sound-reproducer or loud speaker." Brandes Laboratories Inc. September 13th, 1926. (271,326.)

27,528. "Wireless aerial." C. E. Thomason. November 3rd, 1926. (271,331.)

28,420. "Process for the production of a fast adhering metal coating on insulating sheets, especially for the preparation of electric condensers." Dubilier Condenser Co. (1925), Ltd. November 12th, 1925. (261,392.)

30,172. "Lubrication systems for electric motors." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. November 29th, 1926. (271,343.)

30,298. "Radio-signalling systems." British Thomson-Houston Co., Ltd. November 30th, 1925. (262,152.)

30,791. "Electric bright annealing furnaces." Siemens-Elektrowarme-Ges. December 5th, 1925. (Addition to 252,405.) (262,468.)

31,598. "Amplifiers for gramophones, telephonic loud speakers, and the like." T. H. Tulte. December 13th, 1926. (271,351.)

1927.

1,957. "Systems of electric motor control." British Thomson-Houston Co., Ltd. January 22nd, 1926. (264,875.)

5,276. "Electric hair-curling apparatus." H. Rochat. March 1st, 1926. (266,740.)

6,034. "Protected plug-in inductance coils." E. L. Wildy and London Electric Wire Co. & Smiths, Ltd. March 3rd, 1927. (271,384.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERCRAVE.—Houses (200), for the Welsh Anthracite Collieries, Ltd.

ALTRINCHAM (CHESHIRE).—Housing scheme (40), for the U.D.C.; surveyor.

ASHFORD (KENT).—Additional 60 houses, for the U.D.C.; E. Clark & Sons, builders, Melton Mowbray.

AYLESBURY.—Conversion of the Old Manor House into home for mental defectives, for Bucks. C.C.; county architect.

AYRSHIRE.—Shops, hall, and temple for Lodge Troon Navigation, Troon (£4,000); J. R. Johnstone, architect, Troon.

BARLBY.—Factory, foreshore of River Ouse; Yorkshire Sugar Co.

BISHOP AUCKLAND.—Electric washing plant at Maternity Home; Durham County medical officer.

BLACKBURN.—Additional 96 houses, Brownhill, for the T.C.; borough engineer.

BRISTOL.—Crematorium, for the T.C.; H. G. Malcolm Laing, Lincoln's Inn, architect; Alfred Dowling & Son, contractors, 125, North Road, Bishopston.

BULFORD.—School, for Wilts E.C.; director of education, Trowbridge.

CALNE.—School, for Wilts. E.C.; director of education, Trowbridge.

CARLYLE.—Housing scheme (100), with electrical work, for Lanarkshire C.C.; P. C. Smith, District Offices, Hamilton.

CHELTENHAM.—Proposed medical baths at Winter Garden; borough engineer.

CHERTSEY.—Additional 50 houses, for the U.D.C.; Mr. Parker, architect.

CHESTER.—Public offices, Northgate Street, for the T.C.; Charles Greenwood, city engineer.

CHESTERFIELD.—Extensions, Furnace Hill Works; Morgan Crossley & Co., Ltd. Extensions, Portland Works; Robinson & Son, Ltd.

CHIPPING NORTON.—Boys' secondary school, for Oxfordshire E.C.; director of education, Oxford.

COLCHESTER.—Housing scheme (70), for the T.C.; borough surveyor.

CONGLETON (CHESHIRE).—Extensions, Brown Street Mill (£15,000), for W. A. Lowe & Co.

DEWSBURY.—Additional housing scheme (200), for the T.C.; borough surveyor.

DORKING.—Secondary school, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

DOUGLAS (ISLE OF MAN).—Electro-medical pavilion, Noble's Isle of Man Hospital; J. E. Teare, architect, 46, Athol Street.

DUMBARTONSHIRE.—School at Kirkintilloch (£11,000); clerk, Education Authority, Dumbarton.

DUNDEE.—Shops for Eastern Co-operative Society, Ltd.; the manager.

ECCLES.—Additional 78 houses, for the T.C.; borough surveyor.

EDINBURGH.—Conversion of Calton Prison into headquarters of Scottish Command; officer commanding. 570 houses at Prestonfield for Corporation; city architect.

EPSOM.—Re-organisation of institution laundry, with electrical work (£6,502), for the B.G.; the clerk.

FELIXSTOWE.—Bandstand, enclosure and dancing kiosk (£13,000), for the U.D.C.; surveyor.

FENTON.—Oil depot and offices, Argyle Street; Shell-Mex, Ltd.

FIFE.—Extensions at Adamson Cottage Hospital, Cupar; the medical superintendent.

GLASGOW.—Picture house at Carntyne; Messrs. Rosslyn Mitchell & Tullis Cochran, writers, agents. 250 steel houses, Clydebank; Atholl Steel Houses, Ltd.

HALESOWEN.—Conversion of Cornbow House into council chamber and municipal offices, for the U.D.C.; surveyor.

HASTINGS.—Orthopædic and isolation departments, Royal East Sussex Hospital; Percy H. Oxley, architect, 29, Havelock Road.

HEMSWORTH.—Cinema and dance hall; W. P. Peters, architect, 125, Vicar Lane.

HEYSHAM.—Congregational Church, Sefton Road; Messrs. Baines, architects, Morecambe.

HULL.—Installation of electric lighting, Boulevard secondary school; Education Committee.

IRISH FREE STATE (TRANMORE, Co. WATERFORD).—Waterworks scheme, including pump and filtration plant for the County Board of Health; J. F. Delaney, 97, Stephen's Green, Dublin.

KERESLEY.—Cinema, Bennett's Lane, for F. Voce.

KINGSTON-ON-THAMES.—Y.M.C.A. headquarters, Eden Street (£6,000); J. P. Blake, architect.

LONDON (FINCHLEY, N.).—40 houses, Leslie Road and Church Lane; W. Hollis, Junr.

(WOOLWICH, S.E.).—Houses (360), for the T.C.; John Laing and Son, Ltd., builders.

(STREATHAM, S.W.).—School (£18,762), Streatham Vale, for London E.C.; F. & T. Thorne, builders, Isle of Dogs.

LYMINGTON (HANTS.).—Infirmary, for the B.G.; John Bevir, architect, St. Thomas Street.

MITCHAM.—Wilson cottage hospital (£25,000); Chart, Son and Reading, architects.

MOTHERWELL.—Extensions to county hospital, with two new pavilions, operating theatre, &c., for Lanarkshire C.C.; the clerk, Glasgow.

NORTHALLERTON.—Factory extensions, for the Linoleum Manufacturing Co.

NORTHAMPTON.—Grand stand, offices, &c., Weedon Road; Northampton Football Club. Works extension, Fetter Street; Phipps & Son.

OSSETT.—Alterations, Station Road; Yorkshire Penny Bank, Ltd. Housing scheme, Swithenbank Estate; borough engineer.

OXTED.—Secondary school, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames.

PLYMOUTH.—Development, Whitleagh Estate, Higher St. Budeaux; A. Searle & Son. Development, Barne Estate, St. Budeaux; Body & Son. Premises, Mutley Plain; Plymouth Savings Bank. Café and shops, Keyham Road; C. R. Emmett. Foundry, Dartmouth Road, Birmingham Aluminium Casting Co., Ltd. Works, Beakes Road; World's Wear, Ltd. Smallpox hospital, Sparwell; borough engineer.

PURLEY.—Fire station and firemen's houses (£9,351), for the U.D.C.; C. H. Gibson, Ltd., builders, Croydon.

ROCHDALE.—'Bus garage, Mellor Street, housing scheme (188), Castleton Estate; S. H. Morgan, borough surveyor, Town Hall.

ROTHERHAM.—Engineers' workshops, Thames Street and Mary Street; Duncan White (Engineers), Ltd. Electric light installation, Thornhill School; Education Committee. 'Bus garage, tramways depot (£9,950), for the T.C.; borough engineer.

ROWLEY REGIS.—Houses (146), for the U.D.C.; J. Harper and Sons, builders, Blackheath, near Birmingham (78), and Butler Bros., builders, Erdington (68).

RUABON.—Cinema, New High Street, for the Cambrian Border Cinemas Co., Ltd.

RUSHDEN (NORTHANTS.).—Church, for the Wesleyan trustees; secretary.

ST. ALBANS.—Council offices, for the R.D.C.; Mance & Ross, architects, 33, St. Peter's Street.

SMETHWICK.—96 houses by direct labour, Manor Road; borough engineer.

TILBURY.—Church (£4,000), for the Wesleyan trustees; C. M. Shiner, architect, Grays.

TONBRIDGE.—Housing scheme (40), for the U.D.C.; surveyor.

TORQUAY.—Stores at refuse destructor for Corporation; R. Wilkins & Sons, Ltd.

TUNSTALL.—Oil depot and garages, Scotia Road; Anglo-American Oil Co., Ltd.

UDDINGSTON.—Housing scheme (172), with electric lighting, for Lanarkshire C.C.; P. C. Smith, District Offices, Hamilton.

WELLINGTON (SALOP).—Re-erection of saw mill premises, for Groom & Sons (several thousand pounds).

WEST YORKS.—School, at Bramley and Wickersley; Education Department, County Hall, Wakefield.

WHITCHURCH (SALOP).—Housing scheme (42), for the U.D.C.; surveyor.

YORK.—Extensions, tram depôt, Piccadilly; tramway manager.